LA-14095-PR
Progress Report
February 2004

Radionuclide Concentrations in Soils and Vegetation at Low-Level Radioactive Waste Disposal Area G during the 2002 Growing Season (With a Summary of Radionuclide Concentrations in Soils and Vegetation Since 1980)

Los Alamos
NATIONAL LABORATORY

Edited by Hector Hinojosa, Group IM-1
Prepared by Teresa Hiteman, Group RRES-ECO

The most recent reports in this unclassified series are LA-13467-PR, LA-13495-PR, LA-13771-PR, and LA-13942-PR.

LA-14095-PR
Progress Report
February 2004

Radionuclide Concentrations in Soils and Vegetation at Low-Level Radioactive Waste Disposal Area G during the 2002 Growing Season (With a Summary of Radionuclide Concentrations in Soils and Vegetation Since 1980)

by

J. W. Nyhan
P. R. Fresquez
K. D. Bennett
E. A. Lopez

Los Alamos
NATIONAL LABORATORY

CONTENTS

LIST OF FIGURES

LIST OF TABLES

Radionuclide Concentrations in Soils and Vegetation at Low-Level Radioactive Waste Disposal Area G during the 2002 Growing Season (With a Summary of Radionuclide Concentrations in Soils and Vegetation Since 1980)

J.W. Nyhan, P.R. Fresquez, K. Bennett, and E.A. Lopez

ABSTRACT

Soil samples were collected in 2002 at 17 locations and unwashed overstory vegetation samples were collected at 10 locations within and in the immediate vicinity of Area G, the primary disposal facility for low-level radioactive solid waste at Los Alamos National Laboratory (LANL). These samples were analyzed for ^{3}H, ^{238}Pu, ^{239,240}Pu, ^{90}Sr, ^{241}Am, ^{137}Cs, and ^{tot}U and were compared with similar data collected from several regional background sampling locations. Considering all radionuclide assays, 50% of all the soil samples and 43% of all the vegetation samples were considered detectable (results were greater than the total propagated analytical uncertainty [99% confidence level]) and demonstrated concentrations greater than regional statistical reference levels (RSRLs). Elevated concentrations of ^{3}H, ^{238}Pu, and ^{239,240}Pu in soils and overstory vegetation were found in 2002 at most sampling locations in and around Area G. Soil samples were generally less than LANL screening action levels (SALs), with the exception of ^{3}H found in one soil sample collected along the southwestern perimeter of Area G. This sample had a ^{3}H concentration of 22,000 pCi/mL, which is 3.4-fold higher than the ^{3}H SAL of 6400 pCi/mL. Thus, exposure to Area G soils would result in doses greater than the annual 15-mrem limit from any one radionuclide or from all radionuclides combined at this location, unlike all of the other locations where the SAL was not exceeded.

The radionuclide data over 17- and 11-year time periods, for soils and vegetation, respectively, collected since 1980 was assembled, compared with radionuclide RSRL and SAL values, and used to determine statistically whether radionuclide concentrations were increasing or decreasing with time. Statistically significant trends with time were found in 19 out of 45 cases examined. Most radionuclide concentrations in soils and in unwashed overstory and understory vegetation were found to decrease with time. The exception involved soil ^{3}H concentrations collected on the southern and southwestern perimeters of Area G, which exhibited an upward trend with time.

1. INTRODUCTION

Solid radioactive wastes have been disposed of by burial at Los Alamos National Laboratory (LANL) since the early 1940s (Purtymun et al., 1980). Area G is a 25.5-hectare (63-acre) low-level radioactive waste processing and disposal area located on the east end of Mesa del Buey at Technical Area (TA) 54 (Figure 1). Area G was established in 1957 and is the Laboratory's primary radioactive solid waste burial and storage site (Soholt, 1990). Wastes for disposal include contaminated equipment, paper, plastics, clothing, building materials, soils, and process wastes and are placed in pits, trenches, or shafts and then covered with fill material (Hansen et al., 1980). ^{3}H, ^{tot}U, ^{238}Pu, $^{239,240}Pu$, and a variety of fission and activation products are the main isotopes in waste materials deposited at Area G (U.S. DOE, 1979).

As part of the Environmental Surveillance Program (ESP) at LANL, samples of air (LANL, 2002), water (Mullen et al., 1996), small mammals (Biggs et al., 1995, 1997; Bennett et al., 1996; Gonzales et al., 2000a), and bees (Fresquez et al., 1997a; Haarmann and Fresquez, 1998, 1999) are collected annually, semiannually, or as often as funding permits from within and around Area G to monitor and assess the site's impact on the surrounding environment. Radionuclides in game animals such as elk and deer have also been assessed around Area G (Ferenbaugh et al., 1999).

Radionuclide monitoring of soils, sediments, and vegetation has been reported for samples collected in 1980 (Mayfield and Hansen, 1983; Environmental Surveillance Group, 1981), 1982 (Environmental Surveillance Group, 1983), 1985 (Environmental Science Group et al., 1987a), 1986 (Environmental Science Group et al., 1987b), 1987 (Environmental Protection Group et al., 1990), 1993 (Conrad et al., 1995), 1994 (Conrad et al., 1996; Fresquez et al., 1995), 1995 (Childs and Conrad, 1997; Conrad et al., 1995; Fresquez et al., 1996a), 1996 (Childs and Conrad, 1998; Fresquez et al., 1997b), 1997 (Childs and Conrad, 1998; Fresquez et al., 1998a, b), 1998 (Childs and Conrad, 1999; Fresquez et al., 1999a, b), 1999 (Nyhan et al., 2000; Fresquez and Gonzales, 2000), 2000 (Fresquez et al.,

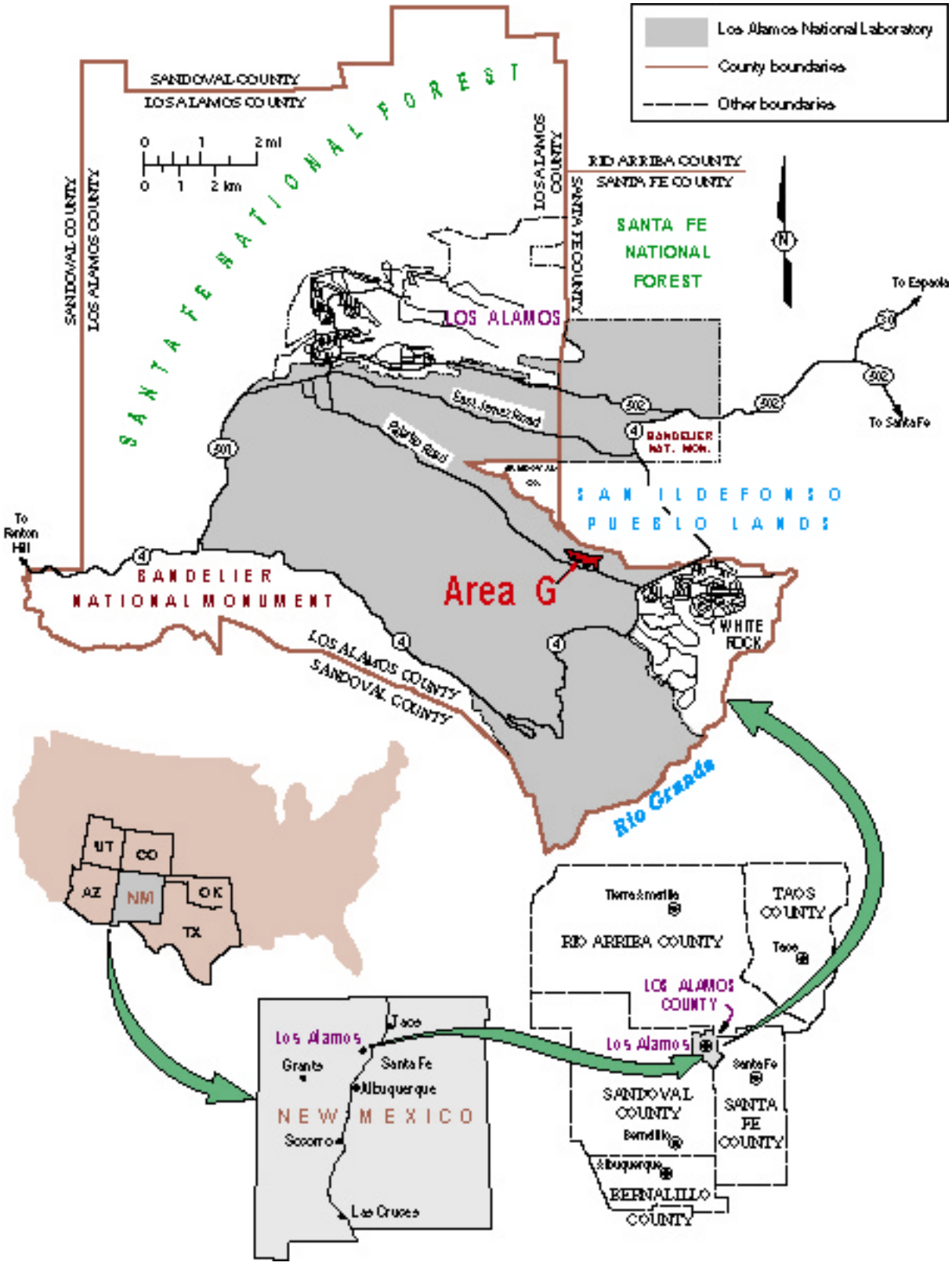

Figure 1. The location of Area G at Los Alamos National Laboratory.

2001; Nyhan et al., 2001), and 2001 (Fresquez et al., 2002). Several reports covering multiple-year periods for soil and vegetation monitoring have also been published (Fresquez et al., 1996b, 1998b; Gonzales et al., 2000b; Jacobson, 1992a, b; Mullen et al., 1996).

Two components of the current Area G surveillance program are the assessments of soil and vegetation within and around Area G for radiological contamination. The soil sampling program is the most direct means of estimating the types, concentrations, and distributions of radionuclides in the environment within and around nuclear facilities (Fresquez, 1998). Soil provides an integrating medium, or reservoir, that can account for contaminants released to the atmosphere, either directly from gaseous effluents, such as air stack emissions, or indirectly from the resuspension of on-site contamination (fugitive dust) (Healy, 1977). Subsequently, the knowledge gained from the radiological surveillance of soil is critical to provide information about potential exposure by way of several pathways that include soil ingestion, consumption of food crops, resuspension of radionuclides into the air, and contamination of groundwater. Exposure to radionuclides by these pathways may result in radiation doses to humans (Hakonson et al., 1981). The uptake of radionuclides by vegetation may also give some insight into surface (Hansen et al., 1980) and subsurface (Wenzel et al., 1987) pathways of contaminants to humans from waste disposal areas. Trees, in particular, have been shown to be excellent indicators of subterranean ^{3}H migration from low-level radioactive waste disposal sites (Rickard and Kirby, 1987).

In the late 1970s, the Atomic Energy Commission issued interim operational criteria for radioactive waste areas owned or operated by them and their contractors (EG&G Idaho, 1978, 1981; Dames and Moore, 1976). As a first response to the surveillance requirements listed in these criteria, personnel from the Environmental Surveillance Group at Los Alamos Scientific Laboratory developed an interim surveillance plan for the site's radioactive waste areas (Hansen et al., 1980) to supplement the Laboratory's general environmental surveillance

effort. Since a portion of the original program code for this program had the designator "A411," this program became known as the A411 Program (Conrad et al., 1995). The first announcement and monitoring results of this program appeared in the 1980 and 1982 Environmental Surveillance Reports, respectively (Environmental Surveillance Group, 1981, 1983), and additional program results have been reported in the 1990s (Conrad et al., 1995, 1996; Childs and Conrad, 1997, 1998, 1999).

The A411 Program investigation focuses principally on the possibility of contaminated sediment movement through surface-water runoff out of the perimeter of Area G. Sampling locations were intentionally selected to best indicate possible contamination moving outside the perimeter of Area G; thus, these sampling locations should be considered as those locations most sensitive to possible contaminant migration.

In the mid 1990s, another major sampling program was initiated by the Laboratory's Ecology Group (RRES-ECO) based on the assessment of vegetation growing within and around Area G for radiological contamination (Fresquez et al., 1995). Piñon pine (*Pinus edulis*) trees (overstory samples) acted as the center of a 30- by 30-ft area square, and grass and forb samples (understory samples), as well as soil samples were collected from the corners of the square. Many direct comparisons were made in this program with soil-plant radionuclide relationships at background locations positioned various distances away from Area G.

All of these monitoring data collected at Area G were compared to radionuclide concentrations in soils and vegetation collected from regional background (RBG) locations. The background areas are located away from LANL, and radionuclide concentrations result from naturally occurring elements and/or from worldwide fallout.

The soils and sediment data collected at Area G are also compared with screening action levels (SALs) established for 24 radionuclides by the Environmental Restoration (ER) Project at Los Alamos (ER, 2001). ER Project radionuclide SALs are applicable for screening contaminated soil at most

potential release sites and are conservatively biased within the bounds of the assumptions used in their calculations. These SAL calculations are based on a residential exposure scenario, which includes exposure pathways for incidental soil ingestion, dust inhalation, plant ingestion, radon inhalation, and external irradiation.

There are several reasons why the ER Project uses a target dose limit of 15 mrem/yr to calculate radionuclide SALs (ER, 2001). To approve cleanup guidelines for releasing sites for unrestricted public use, the US Department of Energy/Albuquerque Operations Office requires that the site-specific modeled dose does not exceed 15 mrem/yr (DOE-AL, 2000). A 15-mrem/yr target dose limit is consistent with published US Environmental Protection Agency (EPA) guidance and is well below the basic dose limit of 100 mrem/yr above background established in US Department of Energy Order 5400.5 (DOE, 1990). The EPA has determined that a target dose limit of 15 mrem/yr equates to an approximate increased lifetime cancer risk of 10^{-4}, and "is consistent with levels generally considered protective in other governmental actions, particularly regulations and guidance developed by EPA in other radiation control programs" (EPA, 1997).

The first objective of this annual survey was to measure the concentrations of selected radionuclides in surface soils and unwashed overstory and understory vegetation within and around Area G during the 2002 growing season. The surface soil data were also collected at the A411 Program sampling locations during 2002. All of these data were then compared to soil and vegetation radionuclide concentrations in background samples collected at various distances away from Area G and to the radionuclide SALs.

The second objective of this survey was to report on the results of all of the known radionuclide monitoring studies for soils and vegetation within Area G and close to the perimeter of Area G. A statistical test was then used to determine whether radionuclide concentrations were increasing or decreasing with time since 1980.

2. METHODS

In March of 2002, the Soils, Foodstuffs, and Biota Environmental Contaminant Surveillance Program Team of LANL's RRES-ECO collected 17 samples of surface soils at former RRES-ECO and A411 Project sampling locations within and around Area G at TA-54 (Figure 2). The RRES-ECO sample location numbers are represented as circles with numbers in the center of each circle in Figure 2.

Each of the A411 Project sampling locations contained an aluminum stake with a brass tag (Conrad et al., 1995) stamped with a unique site identification number identified with a "G-" prefix (shown without the "G-" prefix in Figure 2). Table 1 lists all of the sampling locations and location descriptions that are shown in Figure 2. Although most of the soil samples were collected outside of and adjacent to the Area G fence, several samples were also collected inside of Area G. Sample locations 3, 7a, and 7b are inside the Area G fence. Samples from locations 1, 2, 3b, 4, 6b, 7c, 8, and all six of the A411 Project samples were collected outside the Area G fence. Location 8 is west of Area G in the proposed expansion area. RBG samples of soils were collected as part of the ESP (Fresquez et al., 2003a, b).

Several soil samples were collected at the eastern end of Area G in the vicinity of the transuranic (TRU) waste pads, the site of the Transuranic Waste Inspectable Storage Project (TWISP), which was described previously (LANL, 2001). The TWISP involves retrieving the TRU and TRU mixed waste originally stored on above-grade asphalt pads under earthen cover (TRU Pads 1, 2, and 4). These wastes are temporarily stored in fabric tension-support structures (TWISP Domes) constructed on an asphalt surface until they are transported to burial at the Waste Isolation Pilot Plant. On December 19, 2001, waste handlers at Area G unearthed the last of about 16,700 55-gallon steel drums and 200 fiberglass-reinforced plywood boxes containing TRU waste that had been stored for nearly 20 years on three asphalt pads and then covered with tarps, plywood, and earth (LANL, 2001). Previous A411 Project studies (Childs and Conrad, 1997, 1998, 1999; Conrad et al., 1995, 1996) and one RRES-ECO

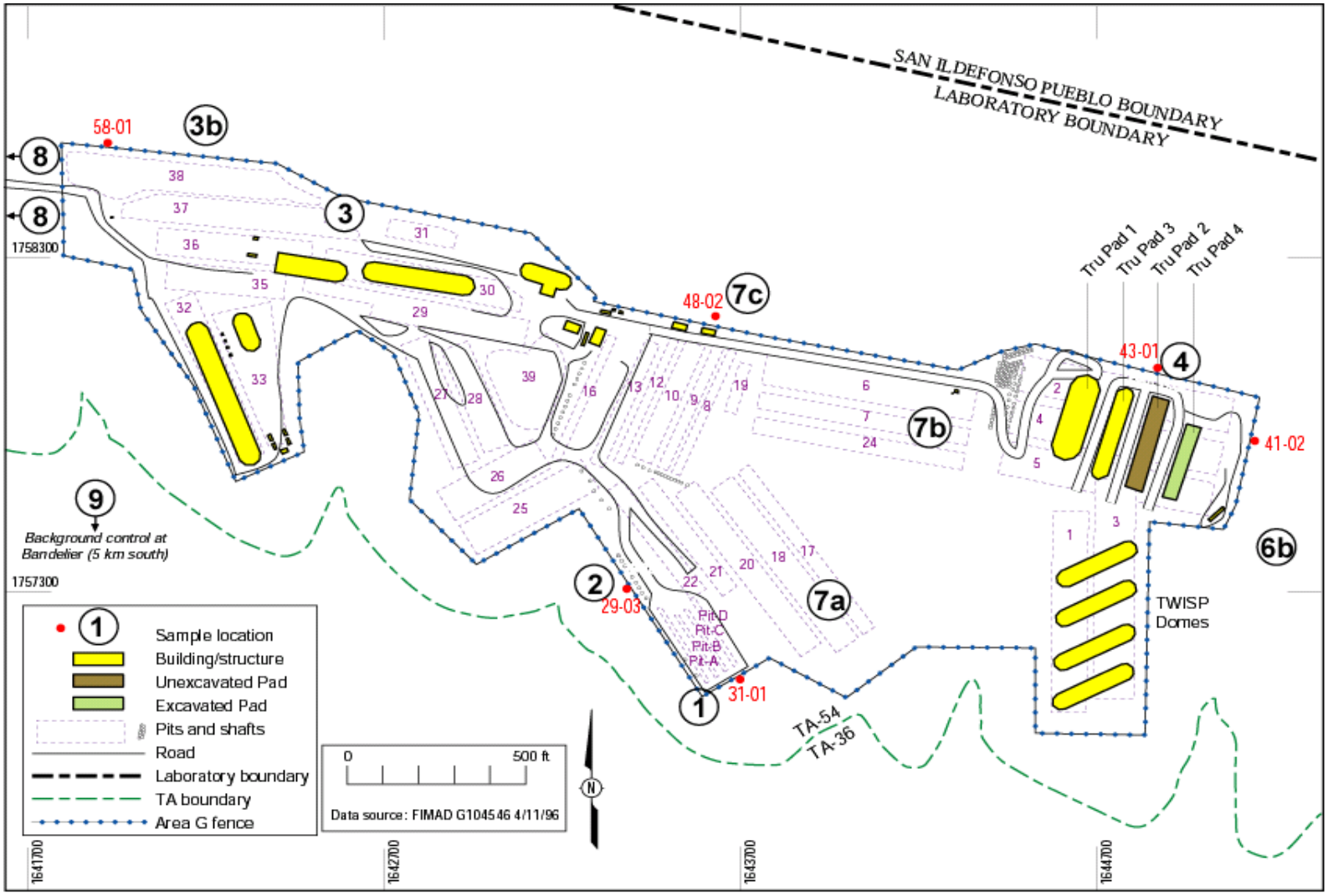

Figure 2. Site/sample locations of soils and vegetation at Area G in 2002.
(Site #8 is located farther west and Site #9 is located farther south than what is shown here.)

Table 1. Sampling Locations Used in 2002 and Shown on Figure 2.

Location Number	Description
1	South of ^{3}H shafts immediately outside the Area G fence
2	West of the high-level ^{3}H shafts immediately outside the Area G fence
3	East of Pit 38 (inside the Area G fence)
3b	North of Pit 38 outside the Area G fence
4	Outside the Area G fence north of the TRU Waste Pads 2 and 4
6b	Southeast of TRU Waste Pad 4 outside Area G fence
7a	Southeastern portions of Pits 17 and 18 (inside the Area G fence)
7b	East end of Pit 7 (inside the Area G fence)
7c	North of Pit 8 outside the Area G fence
8	Proposed expansion area one-half mile west of the entrance gate to Area G and outside the Area G fence
9	Background locations were near Bandelier National Monument approximately 5 km south of Area G
G-29-03	Southwest of Pit 22 (outside the Area G fence)
G-31-01	Southeast of Disposal Trench C (outside the Area G fence)
G-41-02	East of the eastern end of Pit 2 and TRU Pad 4 (outside the Area G fence)
G-43-01	North of TRU Pad 2 (outside the Area G fence)
G-48-02	North of Pit 10 (outside the Area G fence)
G-58-01	North of western end of Pit 38 near gate (outside the Area G fence)

study (Fresquez et al., 1999) have confused the numbering of the TRU Pads at Area G. The reason for this is that they are incorrectly numbered in the Facility for Information Management, Analysis, and Display (FIMAD) system (see Conrad et al., 1995; FIMAD Plot Number 108583). Proceeding from west to east, the TRU pads are correctly numbered 1, 3, 2, and 4 (Figure 2). TRU Pad 3 was never used to store wastes and has had a light-brown-colored fabric tension-support dome over it. Wastes were first excavated from TRU Pad 1, which still has a white-colored fabric tension-support dome over it. TRU Pad 4 was excavated next and currently has a crushed tuff flat surface; thus, location 6 at this pad was removed after sampling in 1997 and is no longer available for sampling (Fresquez, 1998). TRU Pad 2 was fully excavated in 2002 and used to be the location of RRES-ECO sample location 5.

a. Soil Sampling

At each of the A411 Project sampling locations, grab samples of soil were collected in March 2002 from the top 15 cm (6 in.) of the soil surface with either a stainless steel or a disposable polystyrene scoop or scoopula (LANL, 1995). All of the other soil samples were collected from the surface with a stainless steel soil ring 10 cm (4 in.) in diameter driven 5 cm (2 in.) into the soil (ASTM, 1990). Samples were collected from the center and corners of a square plot of 10 m (33 ft) per side. The five subsamples were combined and mixed thoroughly in a 11.4-L (three-gallon) Ziploc® bag, and a subsample from the composite was placed in a 500-mL poly bottle.

All soil samples were submitted under full chain-of-custody (see Appendix A) to Paragon Analytics, Inc., for analysis of ^{3}H, ^{238}Pu, $^{239,240}Pu$, ^{137}Cs, ^{tot}U, ^{90}Sr, and ^{241}Am. All quality assurance/quality control requirements were met by Paragon Analytics, Inc., as well as by the RRES-ECO Quality Assurance Project Plan (Fresquez and Nyhan, 2003).

All methods of radiochemical analyses have been described previously (Fresquez et al., 1996a; Childs and Conrad, 1999). Radionuclide results were reported in pCi/mL of soil moisture for ^{3}H, ppm dry soil for ^{tot}U, and pCi/g dry soil for all the other isotopes (Appendix B).

b. Plant Sampling

Samples of overstory and understory vegetation are normally collected when both types can be found. However, in June 2002, no understory samples could be collected due to the drought. Clippings of tree shoots (overstory) were composited and transported to the laboratory. Overstory samples were collected at all sampling locations from the same 10- by 10-m plots as the soil samples. Overstory samples were mainly from piñon pine because piñon pine is the prevalent tree in the vicinity of Area G (Tierney and Foxx, 1982). Samples of the overstory consisted of the tips of tree shoots approximately 2.5 to 5.1 cm (1 to 2 in.) in length, which were collected at a height of 1.3 to 1.6 m (4 to 5 ft).

Personnel collecting samples wore plastic gloves and used clean shears to clip vegetation; gloves and shears were decontaminated (washed

with soap and water) between sampling locations. Vegetation clippings ranged from 0.9 to 1.4 kg (2 to 3 lb) of composited material, which was placed in labeled double-bagged Ziploc® plastic bags and transported to the laboratory in a locked ice chest. Each sample was divided into two subsets to provide enough material for ^{3}H analysis and for the other radionuclides. Samples were not washed and thus represent the total concentration of radionuclides deposited on the plant surfaces by rainsplash and/or airborne deposition as well as radionuclides taken up by plant roots. The total radionuclide concentration is a realistic measure of the amount available to receptors that consume the plants at Area G.

Part of the vegetation sample was subsampled for ^{3}H analysis. The subsamples were placed in glass beakers to collect distillate water (Salazar, 1984). The remaining portion of each subsample was placed in a 1-L glass beaker and slowly ashed at 500°C for 120 h. The ashed sample was pulverized and homogenized, then transferred to labeled 500-mL poly bottles and submitted with the distillate samples under full chain-of-custody to Paragon Analytics, Inc., for the analysis of ^{3}H, ^{238}Pu, $^{239,240}Pu$, ^{137}Cs, ^{tot}U, ^{241}Am, ^{90}Sr, and ^{tot}U; all quality assurance/quality control requirements were met. All methods of radiochemical analyses have been described previously (Fresquez et al., 1996a) and the methods for estimating Total Propagated Analytical Uncertainty (TPU) for all radiometric analyses were described in detail previously (Nyhan et al., 2002). Radionuclide results were reported in pCi/mL of tissue moisture for ^{3}H, ppm ash for ^{tot}U, and pCi/g ash for all the other isotopes. Results reported in grams of ash are usually two to four orders of magnitude greater than live (wet) weight.

c. Previous Studies

Several soil and plant sampling studies have been performed at Area G since 1980. The 17 soil sampling campaigns and the 11 plant sampling campaigns are documented and described in Table 2 and Table 3, respectively. The sample locations for every campaign are shown in Figure 3.

The database for soil radionuclide concentrations (Table 2) is considerably larger than the vegetation

Table 2. Soil Sampling Studies Performed Since 1980 at Area G.

Year	Perimeter samples	Samples collected inside of Area G	Sample designation	Sample types	Sampling depth (cm)	Reference
1980	8	7	G-1 through G-15	Core	0-1, 1-10[a]	Mayfield and Hansen (1983); Environmental Surveillance Group (1981)
1985	16	0	H-1 through H-16	Core	0-1, 1-10[a]	Environmental Science Group, Environmental Surveillance Group, and Health and Environmental Chemistry Group (1987a)
1986	17	0	H-1 through H-16	Core	0-5	Environmental Science Group, Environmental Surveillance Group, Health and Environmental Chemistry Group, and Waste Management Group (1987b)
1989	11	0	1,1 through 16,1	Core	0-5	Jacobson (1992a, b)
1993	76	0	G-13-01 through G-58-01	Core	0-15	Conrad et al. (1995)

Table 2. Soil Sampling Studies Performed since 1980 at Area G (Cont.).

Year	Perimeter samples	Samples collected inside of Area G	Sample designation	Sample types	Sampling depth (cm)	Reference
1994	77	11	G-13-01 through G-60-01	Core	0-15	Conrad et al. (1996)
1995	44	5	G-29-01 through G-60-01	Core	0-15	Childs and Conrad (1997)
1996	35	5	G-29-01 through G-58-01	Core	0-15	Childs and Conrad (1998)
1996	5	4	1 through 9	Composite core	0-5	Fresquez et al. (1997b)
1997	37	3	G-29-01 through G-58-01	Core	0-15	Childs and Conrad (1998)
1997	5	4	1 through 9	Composite core	0-5	Fresquez et al. (1998a)
1998	35	4	G-29-01 through G-58-01	Core	0-15	Childs and Conrad (1999)
1998	5	4	1 through 9	Composite core	0-5	Fresquez et al. (1999)
1999	43	9	G-29-01 through G-58-01	Core	0-15	Nyhan et al. (2000)
1999	5	4	1 through 9	Composite core	0-5	Nyhan et al. (2000)
2000	14	4	G-29-01 through G-58-01	Core	0-15	Nyhan et al. (2001)

Table 2. Soil Sampling Studies Performed Since 1980 at Area G (Cont.).

Year	Perimeter samples	Samples collected inside of Area G	Sample designation	Sample types	Sampling depth (cm)	Reference
2000	5	4	1 through 9	Composite core	0-5	Nyhan et al. (2001)
2001	14	3	G-29-01 through G-58-01	Core	0-15	Nyhan et al. (2002)
2001	5	4	1 through 9	Compositecore	0-5	Nyhan et al. (2002)
2002	15	3	G-29-01 through G-58-01	Core	0-15	This report: Nyhan et al. (2003)
2002	5	4	1 through 9	Composite core	0-5	This report: Nyhan et al. (2003)

[a] Radionuclide concentrations from both depths averaged.

Table 3. Vegetation Sampling Studies Performed Since 1980 at Area G.

Year	Perimeter samples		Samples collected inside of Area G		Sample designation	Sample types	References
	OS[1]	US[1]	OS	US			
1980	5	9	2	11	G-1 through G-15	Individual plant	Mayfield and Hansen (1983); Environmental Surveillance Group (1981)
1985	17	12	0	0	H-1 through H-16	Individual plant	Environmental Science Group, Environmental Surveillance Group, and Health and Environmental Chemistry Group (1987a)
1986	0	15	0	0	H-1 through H-16	Individual plant	Environmental Science Group, Environmental Surveillance Group, Health and Environmental Chemistry Group, and Waste Management Group (1987b)
1994	4	4	1	3	G-13-01 through G-60-01	Individual plant	Conrad et al. (1996)
1995	4	4	1	3	G-29-01 through G-60-01	Individual plant	Childs and Conrad (1997)
1996	4	4	1	3	1 through 9	Composite	Fresquez et al. (1997b)
1997	4	4	1	3	1 through 9	Composite	Fresquez et al. (1998a)

Table 3. Vegetation Sampling Studies Performed Since 1980 at Area G.

Year	Perimeter samples		Samples collected inside of Area G		Sample designation	Sample types	References
	OS[1]	US[1]	OS	US			
1998	4	4	1	2	1 through 9	Composite	Fresquez et al. (1999)
1999	8	8	1	4	1 through 9	Composite	Nyhan et al. (2000)
2001	8	7	1	3	1 through 9	Composite	Nyhan et al. (2002)
2002	7	0	1	0	1 through 9	Composite	This report: Nyhan et al. (2003)

[1]OS and US signify overstory (tree) and understory (grass and shrubs).

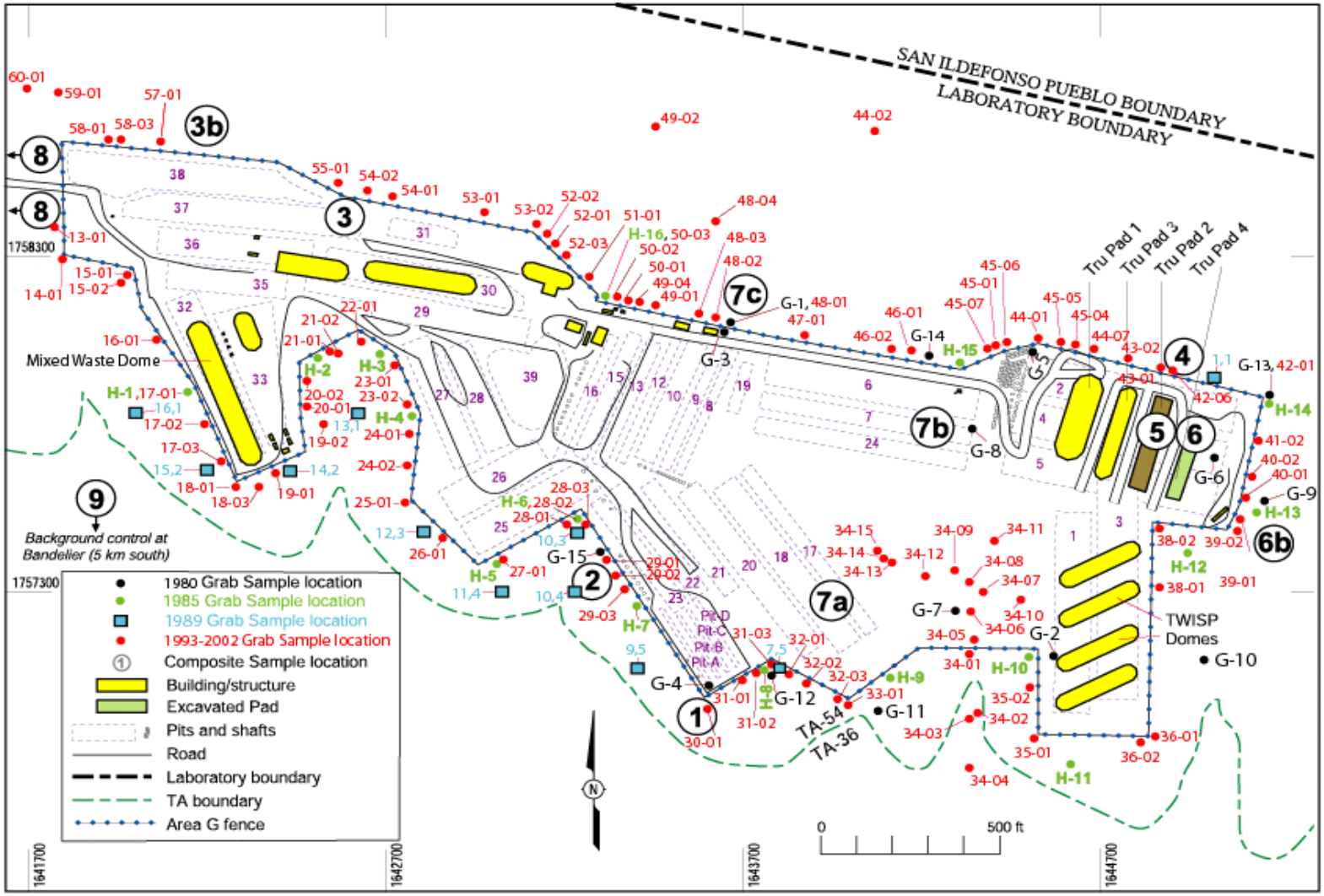

Figure 3. Site-sample locations of soils and vegetation at Area G. (Site #8 is located farther west and Site #9 is located farther south than what is shown here.) Samples designated by red circles in legend are described with a G-prefix in tables and text.

database (Table 3). There were 457 perimeter soil samples collected at Area G and 66 soil samples collected inside of Area G (Table 2). In contrast, Table 3 lists only 111 vegetation samples collected on the perimeter of Area G, with 42 samples collected inside of Area G.

In addition, radionuclide concentrations in soil and vegetation were monitored at RBG stations. These background areas are located at such a distance away from the Laboratory that their radionuclide contents are mostly due to naturally occurring elements or to worldwide fallout. The soils database will not be presented here as it is published every year in the ESP report. However, the database for the radionuclides in vegetation at RBG stations has not been published consistently in one publication, so this information is summarized in Appendix C. The data presented in Table C-1 of this appendix list only 30 vegetation samples collected since 1994 for radionuclide analysis.

d. Statistical Methods used for Analysis of Historical Radionuclide Data

Goodness-of-fit tests indicate whether or not it is reasonable to assume that a random sample comes from a specific distribution. Statistical techniques often rely on observations having come from a population that has a distribution of a specific form (e.g., normal, lognormal, Poisson, etc.). Standard control charts for continuous measurements, for instance, require that the data come from a normal distribution. Accurate lifetime modeling requires specifying the correct distributional model. There may be historical or theoretical reasons to assume that a sample comes from a particular population, as well. Past data may have consistently fit a known distribution, for example, or theory may predict that the underlying population should be of a specific form.

The Shapiro-Wilk test, proposed in 1965 (Shapiro and Wilk, 1965), calculates a W statistic that tests whether a random sample, X_1, X_2, ..., X_n (where X is a particular radionuclide concentration for a sample collected at a specific sampling time and location in this study) comes from (specifically) a normal distribution.

Small values of W are evidence of departure from normality; this test has

done very well in comparison studies with other goodness-of-fit tests (see http://www.itl.nist.gov/div898/handbook/prc/section2/prc213.htm).

Correlations measure how variables or rank orders are related. In our case, we are interested in finding out whether or not radionuclide concentrations are increasing or decreasing with time. Pearson's correlation coefficient (Pearson, 1931) is a measure of linear association: two variables can be perfectly related, but if the relationship is not linear, Pearson's correlation coefficient is not an appropriate statistic for measuring their association.

When the data were not normally distributed, we used a rank correlation method, where Kendall's tau-b (Kendall, 1975) coefficients were calculated instead. This method does not require an assumption of normality since it uses the ranks of the observations to estimate the correlation coefficient.

3. RESULTS FOR SAMPLES COLLECTED IN 2002

a. Soil Radionuclide Concentrations

Results of radionuclide concentrations in soils are given in Table 4. The chain-of-custody records and actual Paragon Analytics, Inc., analytical reports are included in Appendices A and B, respectively, for reference.

Considering all radionuclide assays and all of the samples collected (except for samples collected at locations 8 and 9), detectable concentrations of radionuclides (assays with values greater than the TPU [99% confidence level]) were found in most soil samples. None of the assays for soil ^{90}Sr were detectable and only 33% of the soil ^{137}Cs assays were detectable.

Of the 15 soil samples collected in and around Area G (excluding the samples from locations 8 and 9), 93%, 93%, 47%, and 60% of the samples contained ^{239,240}Pu, ^{3}H, ^{241}Am, and ^{238}Pu, respectively, that were both detectable and greater than the RSRL concentrations of these radionuclides (bold values in Table 4). The RSRL is the mean plus two standard deviations of the upper 95% confidence interval of RBG sample concentrations collected from 1998 through 2002 (Fresquez et al., 2003a). The data for the RBG concentrations were collected in 2002 from Embudo, Cochiti, Jemez, and Bandelier (Fresquez et al., 2003a).

Table 4. Mean Radionuclide Concentrations (TPU, 99% confidence level) in Soils (dry weight) Collected from Area G in 2002[1]. Bold Values are Equal to or Greater Than Both the TPU and Regional Statistical Reference Level (RSRL) Values.

Sample Locations	Radionuclide						
	^{3}H (pCi/mL)[2]	^{241}Am (pCi/g)	^{137}Cs (pCi/g)	^{238}Pu (pCi/g)	^{239,240}Pu (pCi/g)	^{90}Sr (pCi/g)	^{tot}U (ppm)
1	**370** (71)	0.0088 (0.0074)	0.42 (0.21)	0.0023 (0.0053)	**0.027** (0.012)	0.12 (0.27)	3.2 (0.87)
2	**273** (53)	0.0053 (0.0055)	0.32 (0.33)	0.0046 (0.0062)	**0.026** (0.011)	0.21 (0.24)	2.9 (0.81)
3	**7.2** (3.2)	**0.021** (0.012)	0.36 (0.13)	**0.010** (0.0071)	**0.045** (0.015)	0.15 (0.24)	2.7 (0.74)
3b	**6.7** (3.3)	0.010 (0.0077)	0.35 (0.17)	**0.0069** (0.0057)	**0.020** (0.010)	0.050 (0.24)	2.5 (0.69)
4	**3.3** (3.0)	**0.21** (0.053)	**0.78** (0.30)	**0.53** (0.15)	**0.41** (0.12)	0.30 (0.27)	**3.5** (0.90)
6b	2.0 (2.3)	**0.031** (0.015)	0.15 (0.12)	0.010 (0.015)	**0.12** (0.048)	0.21 (0.27)	2.2 (0.65)
7a	**152** (29)	0.0033 (0.0057)	0.046 (0.074)	0.016 (0.017)	0.0090 (0.011)	0.030 (0.24)	3.2 (0.81)
7b	**6.1** (2.4)	0.0075 (0.0083)	0.028 (0.072)	**0.0081** (0.0060)	**0.061** (0.018)	-0.040 (0.195)	3.2 (0.89)
7c	**6.9** (4.2)	**0.052** (0.020)	0.021 (0.075)	**0.035** (0.015)	**0.35** (0.075)	0.070 (0.21)	2.5 (0.69)
8	1.7 (2.7)	0.0064 (0.0060)	0.35 (0.14)	0.0023 (0.0045)	**0.027** (0.011)	0.10 (0.21)	3.0 (0.84)
G-29-03	**22000** (4200)	0.0081 (0.0072)	0.42 (0.17)	0.0041 (0.0048)	**0.026** (0.011)	0.12 (0.23)	2.9 (0.74)
G-31-01	**470** (90)	0.0071 (0.0075)	0.11 (0.081)	**0.0069** (0.0066)	**0.029** (0.012)	0.060 (0.21)	2.6 (0.69)
G-41-02	**4.8** (2.9)	**0.15** (0.041)	**0.52** (0.18)	**1.9** (0.36)	**0.55** (0.11)	0.20 (0.24)	**3.7** (0.93)
G-43-01	**6.4** (3.5)	**0.37** (0.084)	**0.47** (0.21)	**0.28** (0.062)	**0.61** (0.12)	0.17 (0.26)	3.1 (0.81)
G-48-02	**8.3** (3.6)	**0.16** (0.044)	**0.56** (0.23)	**0.19** (0.047)	**0.77** (0.15)	0.12 (0.23)	3.0 (0.83)
G-58-01	**6.3** (2.7)	0.0091 (0.0074)	**0.55** (0.21)	0.0039 (0.0065)	**0.032** (0.014)	0.19 (0.24)	3.0 (0.80)
BG (9)	1.0 (1.7)	0.0056 (0.0051)	0.32 (0.14)	-0.00090 (0.0036)	0.011 (0.0066)	0.10 (0.23)	2.9 (0.75)
RBG[3]	0.29	0.0059	0.23	0.00099	0.0085	0.18	2.2
RSRL[4]	0.73	0.014	0.45	0.0044	0.019	0.36	3.2
SAL[5]	6400	39	5.3	49	44	5.7	100

[1]See Table 1 and Fig. 1 for sample location points; samples without a G prefix collected at the 0- to 2-inch depth; samples with a G prefix collected at the 0- to 6-inch depth.
[2]Concentration for ^{3}H is based on soil moisture: a value of 1900 is equivalent to a value of 260 pCi/g ^{3}H for a soil at a water content of 12%.
[3]Regional background is the mean background concentration for samples collected in 2002 for samples from Embudo, Cochiti, Jemez, and Bandelier.
[4]Regional statistical reference level; this is the upper (95%) level background concentration (mean + 2 std dev) from 1998–2002 for samples from Embudo, Cochiti, Jemez, and Bandelier (Fresquez et al., 2003a).
[5]Screening Action Level (ER, 2001).

One sample collected on the perimeter of Area G exceeded the SAL concentration for ^{3}H in soils (Table 4). The soil sample collected at location G-29-03 exhibited a ^{3}H concentration of 22,000 pCi/mL, compared with the ^{3}H SAL level of 6400 pCi/mL. Exposure to this soil would result in doses greater than the annual 15-mrem limit from any one radionuclide or from all radionuclides combined, unlike the soils at all of the other sampling locations where the SAL was not exceeded. Thus, in accordance with the procedures set forth in our Quality Assurance Project Plan (Fresquez and Nyhan, 2003), Area G personnel and Laboratory managers were notified of this occurrence in August 2002.

Several sampling locations were close to one another within the two project sampling schemes and yielded similar radionuclide concentrations for samples collected outside of Area G in 2002 (Figure 2, Table 2, Figure 4). Near the ^{3}H shafts, sample location 1 was close to location G-31-01, and sample location 2 (Figure 4) was close to sampling location G-29-03 (the location with the elevated soil ^{3}H concentration). Sample locations 3b and G-58-01 are near the northwestern corner of Area G. Sample locations 6b and G-41-02 are both near the corner of Area G that is either south or east of TRU Pad 4. Sample locations 4 and G-43-01 are all directly north of the TRU pads. Sample locations 7c and G-48-02 are both north of Pit 8 on the northern extremity of Area G.

The ^{3}H concentrations observed in the soil samples exhibited substantial spatial variability (Table 2, Figures 4 and 5): 93% of the soils analyzed for ^{3}H had concentrations that ranged from 1.0 to 1000 pCi/mL. Samples in the proximity of the ^{3}H shafts (locations 1, 2, 7a, G-29-03, and G-31-01) contained an average ^{3}H concentration of 4653 pCi/mL in 2002, compared with a value of 681 pCi/mL in 2001 (Nyhan et al., 2002). These locations also contained the largest concentration of ^{3}H observed in the study, 22,000 pCi/mL: more than the SAL of 6400 pCi/mL. Several other soil samples containing ^{3}H concentrations greater than the RSRL occurred around the northeastern corner and northern

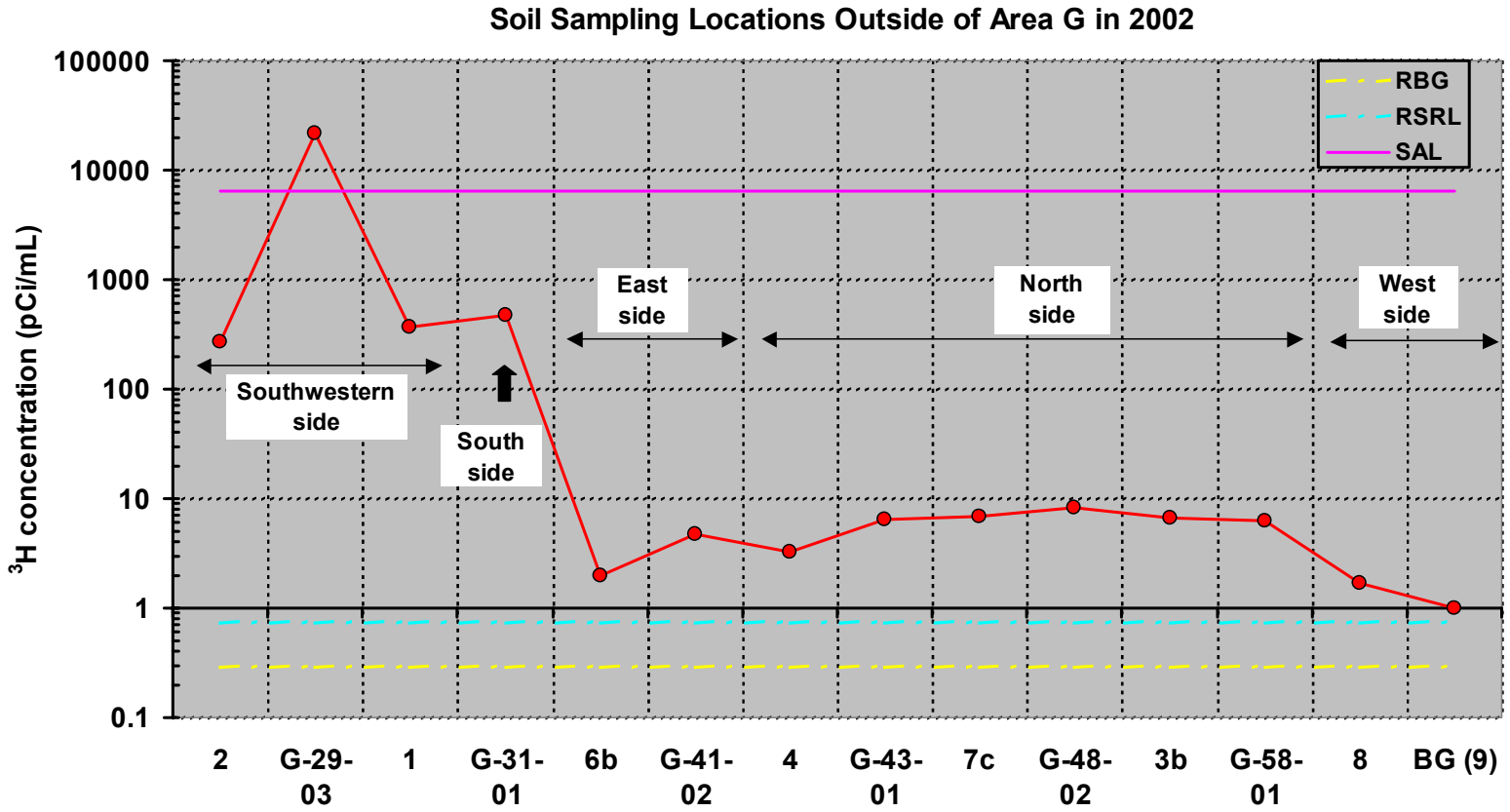

Figure 4. ^{3}H concentrations in soil samples collected outside of Area G in 2002.

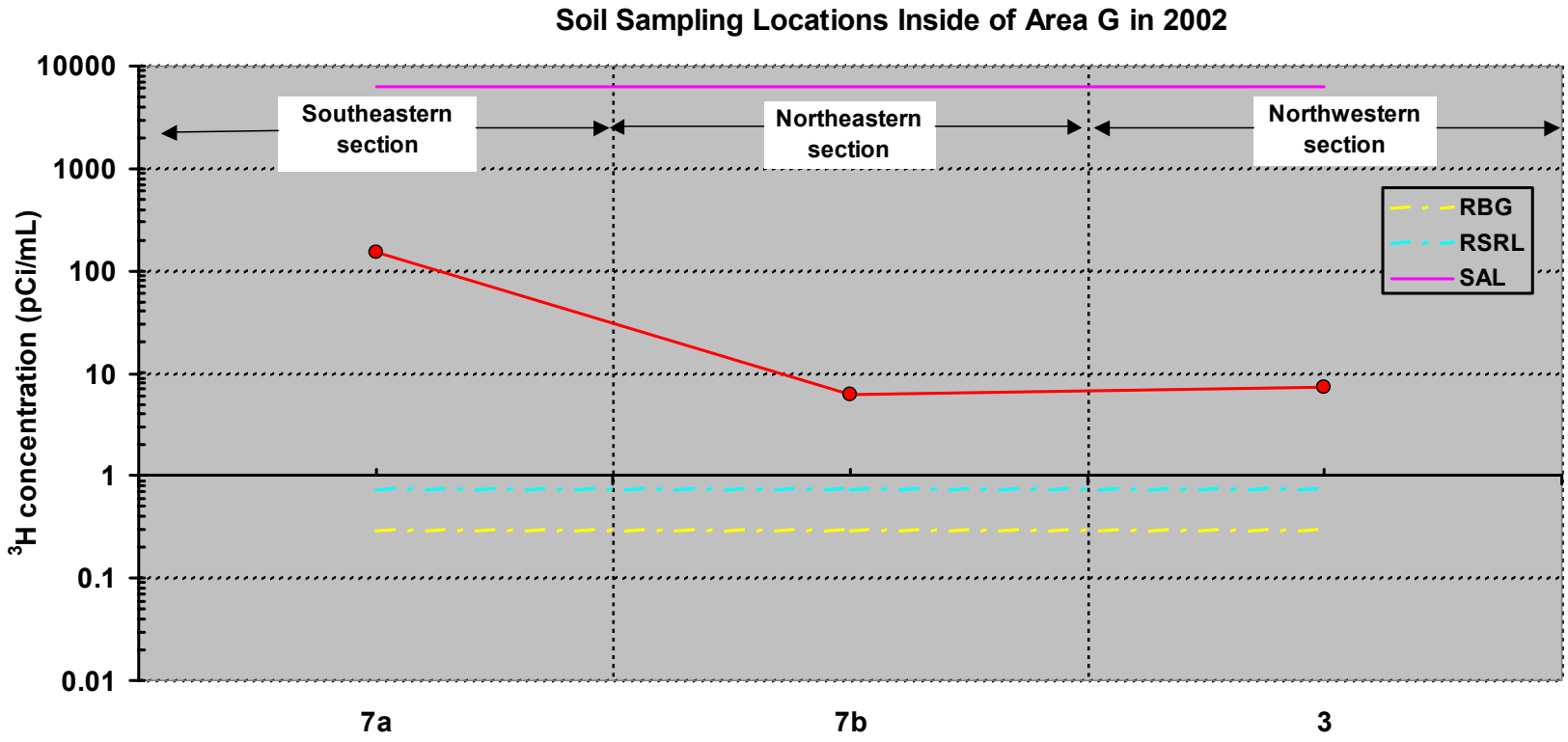

Figure 5. ^{3}H concentrations in soil samples collected inside of Area G in 2002.

perimeter of Area G (locations 6b, G-41-02, 4, G-43-01, 7c, G-48-02, 3b, and G-58-01). The latter soil samples contained an average ^{3}H concentration of 5.6 pCi/mL and a maximum ^{3}H concentration of only 8.3 pCi/mL.

The ^{137}Cs concentrations observed in the soil samples exhibited much less spatial variability than ^{3}H (Table 2): the mean ^{137}Cs concentration of all of the soil samples (except the samples from stations 8 and 9) collected was 0.34 pCi/g with a coefficient of determination (standard deviation multiplied by 100 divided by the mean concentration) of only 67%. Concentrations of ^{137}Cs found in soils collected at Area G in 2002 ranged from 0.021 to 0.78 pCi/g. Over 67% of the soil samples analyzed for ^{137}Cs had concentrations that were less than RSRLs, regardless of how and where the samples were collected (Table 4). Only the samples from locations 4, G-41-02, G-43-01, G-48-02, and G-58-01 contained ^{137}Cs concentrations slightly greater than the RSRL.

Concentrations of ^{tot}U were lower than RSRLs for all Area G locations except for locations 4 and G-41-02 (Table 4), similar to the results for samples collected in 2001 (Nyhan et al., 2002). Uranium concentrations in Bandelier Tuff range up to 11 ppm (Crowe et al., 1978) and could explain the observed variation in the results. Concentrations of ^{tot}U in the soil samples ranged from 2.2 to 3.7 ppm, concentrations that do not pose significantly larger health risks than RBG concentrations to humans or the environment.

Concentrations of $^{239,240}Pu$ found in soils collected at Area G in 2002 ranged from 0.0090 to 0.77 pCi/g; whereas ^{238}Pu concentrations ranged from 0.0023 to 1.9 pCi/g (Table 4). Both of these ranges in concentrations are about the same as those reported for 1999, 2000, and 2001 (Nyhan et al., 2000, 2001, 2002). The concentrations of $^{239,240}Pu$ and ^{238}Pu found in soil samples were usually greater than RSRLs, regardless of how and where the samples were collected at Area G. Almost 93% and 67% of the soil samples (excluding samples from stations 8 and 9) contained greater than RSRL concentrations of $^{239,240}Pu$ and ^{238}Pu, respectively.

The concentrations of ^{239,240}Pu and ^{238}Pu found in soil, as well as the ratios of their concentrations, are presented in Figures 6 and 7 for the samples collected outside and inside of Area G, respectively. Thus, although the soil at location G-48-02 contained the largest concentration of ^{239,240}Pu (0.77pCi/g), the soil from location G-41-02 contained the largest concentration of ^{238}Pu (similar to the results for the samples collected in 2000 and 2001) (Nyhan et al., 2001, 2002). Concentrations of these two isotopes in soils were not significantly correlated ($\alpha = 0.05$, $n = 12$). However, when we took into account that concentrations of both of these radionuclides were log-normally distributed, the results of a single factor analysis of variance test of the log-transformed values showed these two radionuclides were significantly correlated ($\alpha = 0.00024$, $n = 12$, $r^2 = 0.76$), as can be observed by inspection of Figures 6 and 7.

Over 92% of the soil samples collected contained ratios of the concentrations of ^{239,240}Pu to ^{238}Pu with values ranging from 1 to 10; this ratio ranged from 0.29 to 12 for all of the samples collected (samples from locations 8 and 9 excluded) (Figures 6 and 7).

Perimeter soil samples collected on the eastern corner of Area G (sample location 6b) and the north-central section of Area G (locations 7c and G-48-02) exhibited large ratios of the concentrations of ^{239,240}Pu to ^{238}Pu (Figures 2, 6, and 7). These three sample locations are near the TRU pads and pits 8, 9, 10, 12, 13, 15, and 16, respectively, all of which contain waste that was contaminated with both plutonium isotopes.

About half of the soil samples analyzed for ^{241}Am had concentrations that were greater than RSRL concentrations (Table 4, Figures 8 and 9). Concentrations of ^{241}Am found in soils collected at Area G in 2002 ranged from 0.00033 to 0.37 pCi/g. However, with a sample size of only 15, ^{241}Am concentrations observed in the soil samples exhibited about the same spatial variability as either ^{3}H (Figures 4 and 5) or plutonium (Figures 6 and 7). About 74% of the soils analyzed for ^{241}Am in

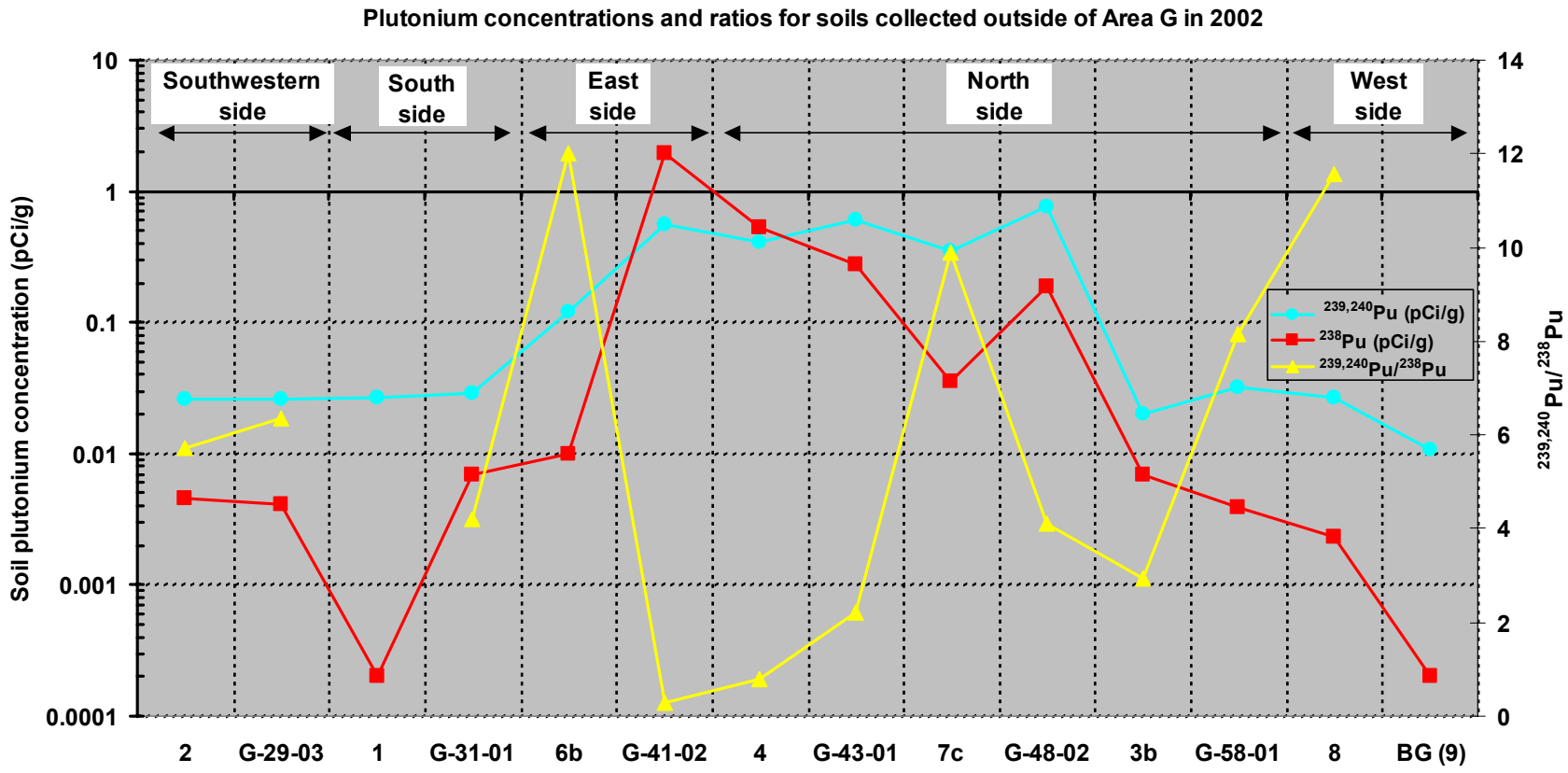

Figure 6. Plutonium concentrations and plutonium isotope ratios in soil samples collected outside of Area G in 2002.

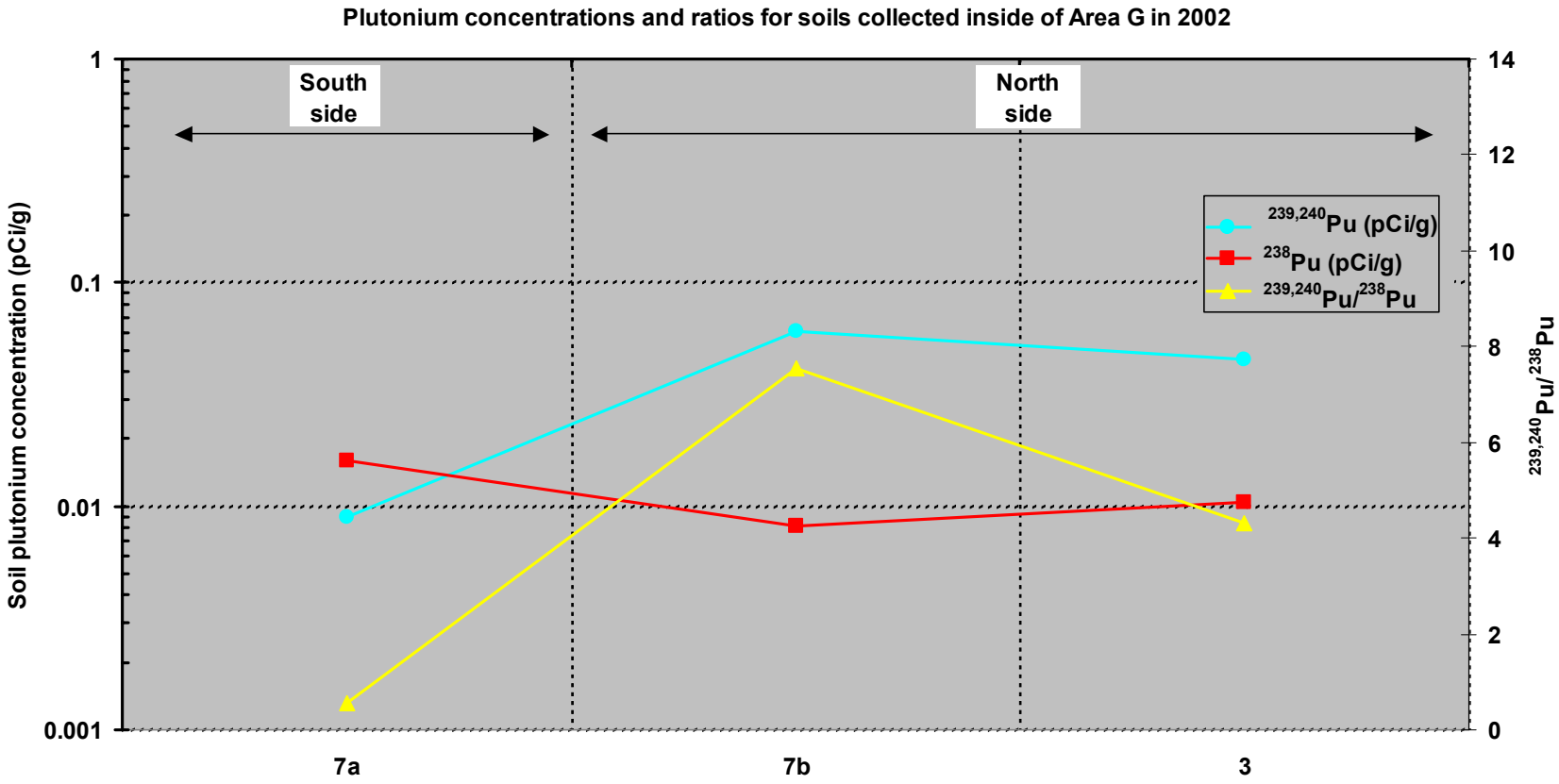

Figure 7. Plutonium concentrations and plutonium isotope ratios in soil samples collected inside of Area G in 2002.

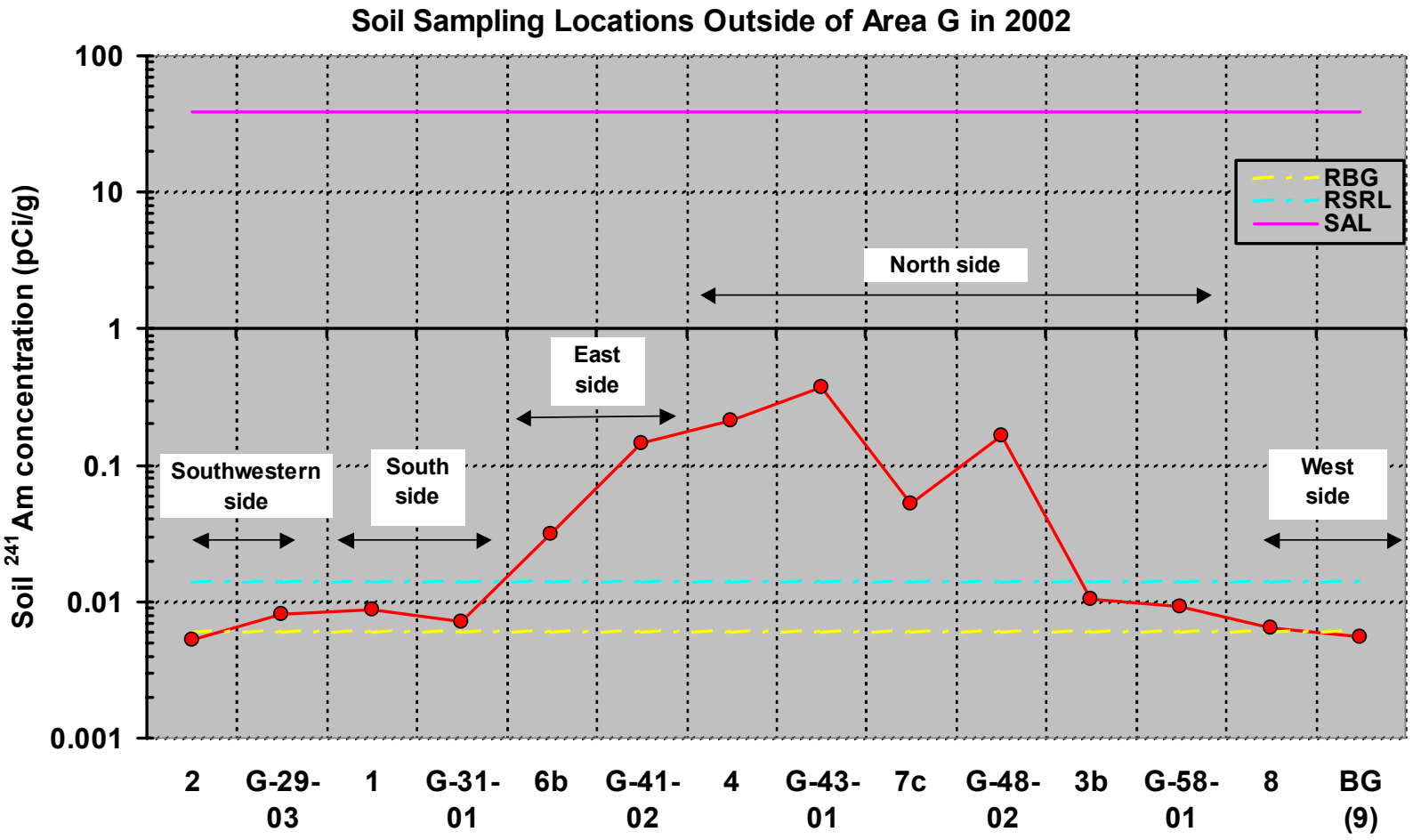

Figure 8. Concentrations of ^{241}Am in soil samples collected outside of Area G in 2002.

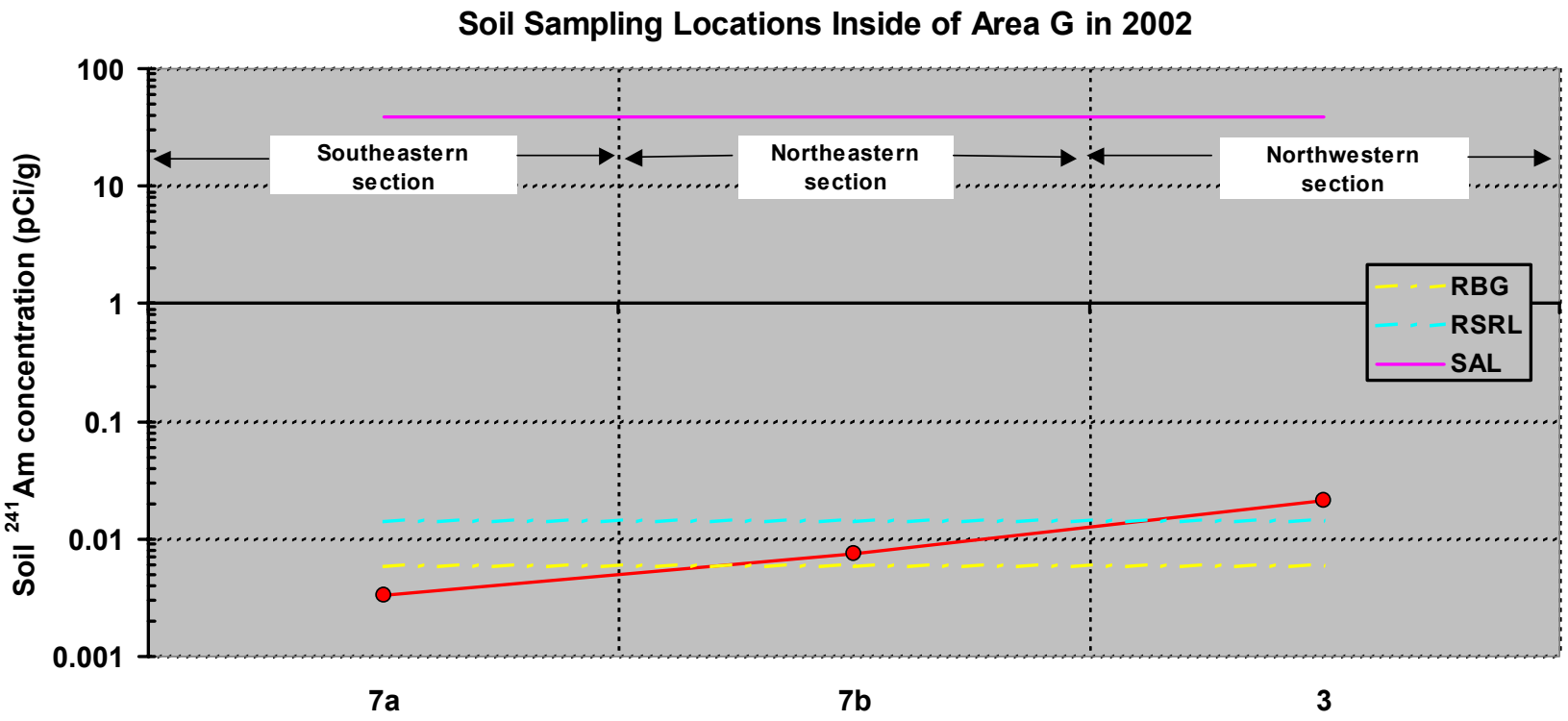

Figure 9. Concentrations of ^{241}Am in soil samples collected inside of Area G in 2002.

2002 had concentrations that were less than 0.10 pCi/g.

Another observation concerning the distribution of ^{241}Am concentrations in the soils at Area G related to the occurrence of soil ^{239,240}Pu (Figures 10 and 11). The concentrations of ^{241}Am and ^{239,240}Pu were significantly correlated for the samples collected outside of Area G ($r^2 = 0.67$, n = 12). This probably means that the source terms in the wastes buried at Area G for both of these radionuclides are similar, as well as their migration mechanisms.

b. Radionuclide Concentrations in Plants

Table 5 shows radionuclide concentrations in unwashed vegetation collected from within and around Area G during the 2002 growing season. The Paragon Analytics, Inc., analytical reports are included in Appendix B for reference. Only overstory vegetation samples were gathered at each sampling location, because there were no understory samples available at the sampling locations in sufficient quantity to sample in 2002 due to the on-going drought.

Unlike the radionuclide data shown in Table 4 for the soils, most radionuclide concentrations in unwashed overstory vegetation were usually not equal to or greater than both the TPU (99% confidence level) and RSRL values (bold values in Table 5). The RSRL mean values plus two standard deviations were calculated from data collected from 1998 to 2002 (Table C-1). Of the eight vegetation samples collected in and around Area G (excluding samples collected at sampling locations 8 and 9), 100%, 63%, 50%, and 38% of the samples contained ^{3}H, ^{239,240}Pu, ^{238}Pu, and ^{241}Am, respectively, greater than both the TPU (99% confidence level) and RSRL values.

The ^{3}H concentrations in vegetation samples (excluding samples collected at sampling locations 8 and 9) had a mean concentration of 116 pCi/mL and ranged from 2.2 to 762 pCi/mL for the eight samples assayed (Table 5, Figure 12). As in previous years (Nyhan et al., 2002), ^{3}H concentrations in overstory vegetation collected outside of Area G and adjacent to the ^{3}H shafts (locations 1 and 2) exhibited the largest concentrations of any of the samples collected outside of Area G (Figure 12). Vegetation samples collected outside of

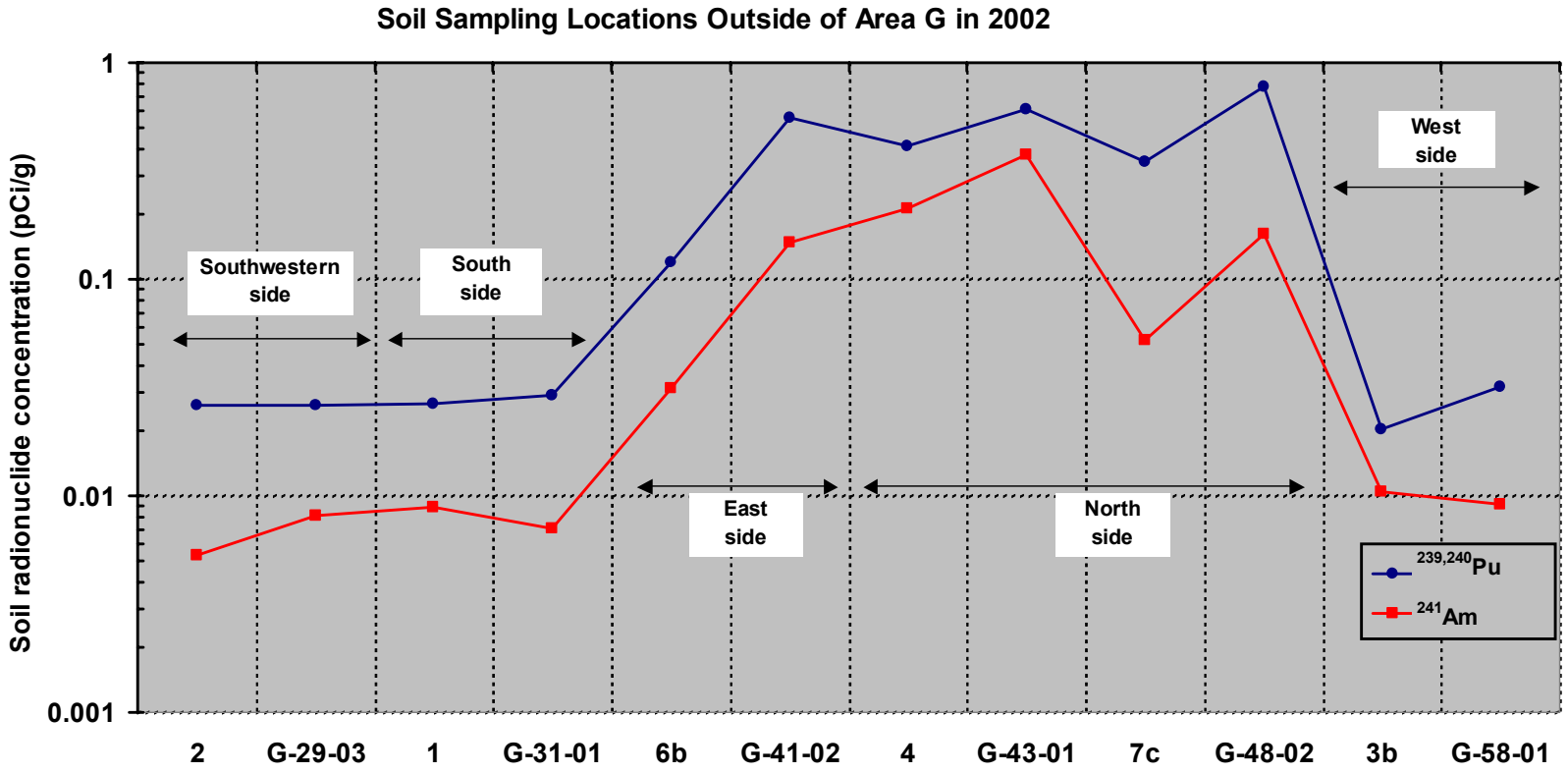

Figure 10. Concentrations of ^{241}Am and ^{239,240}Pu in soil samples collected outside of Area G in 2002.

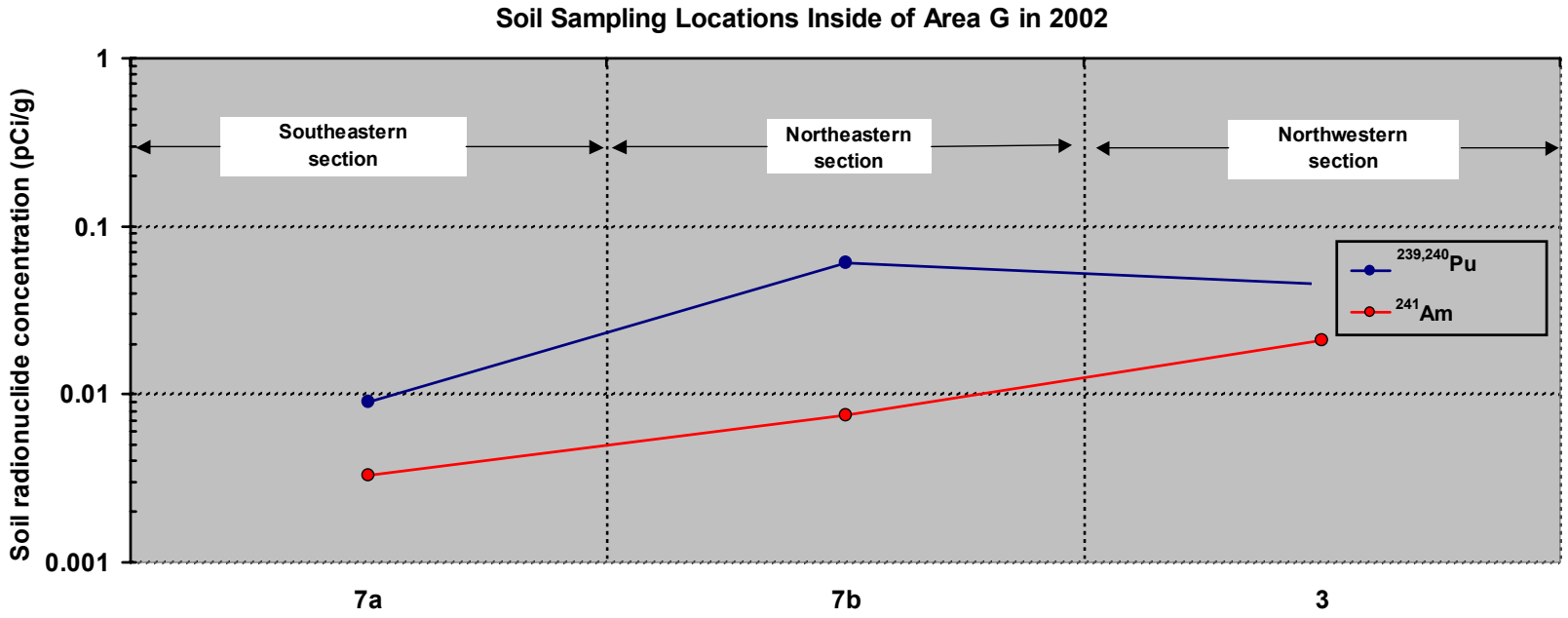

Figure 11. Concentrations of ^{241}Am and ^{239,240}Pu in soil samples collected inside of Area G in 2002.

Table 5. Radionuclide Concentrations (TPU, 99% confidence level) in Unwashed Vegetation Collected from Area G in 2002 (Understory Vegetation Samples not Collected due to Drought). Bold Values are Equal to or Greater than Both the TPU and RSRL Values.

Sample Location and Type[1]	^{3}H (pCi/mL)[2]	^{241}Am (pCi/g ash)	^{137}Cs (pCi/g ash)	^{238}Pu (pCi/g ash)	^{239,240}Pu (pCi/g ash)	^{90}Sr (pCi/g ash)	^{tot}U (ppm ash)
1-OS	**762** (146)	0.049 (0.026)	-0.27 (0.49)	0.0045 (0.0057)	**0.11** (0.035)	3.9 (1.1)	0.63 (0.15)
2-OS	**122** (24)	0.013 (0.010)	-0.070 (0.38)	-0.0017 (0.0093)	0.029 (0.018)	4.7 (1.3)	0.49 (0.13)
3-OS	**8.8** (1.8)	0.040 (0.035)	-0.18 (0.54)	0.0064 (0.0069)	0.029 (0.015)	1.4 (0.39)	**0.80** (0.20)
3b-OS	**3.0** (0.81)	0.011 (0.011)	-0.050 (0.51)	0.0057 (0.0083)	0.035 (0.018)	2.9 (0.78)	**0.78** (0.18)
4-OS	**13** (2.6)	**2.7** (0.53)	0.23 (0.38)	**0.084** (0.030)	**2.4** (0.51)	**12** (3.2)	0.57 (0.15)
6b-OS	**2.2** (0.68)	**0.41** (0.096)	0.14 (0.75)	**0.026** (0.014)	**0.74** (0.17)	4.1 (1.1)	0.39 (0.11)
7c-OS	**8.6** (1.8)	0.047 (0.020)	-0.13 (0.54)	**0.013** (0.0098)	**0.12** (0.036)	4.2 (1.1)	0.48 (0.13)
8-OS	**8.5** (1.8)	0.011 (0.041)	-0.12 (0.47)	0.0036 (0.0048)	0.0021 (0.0042)	3.4 (0.93)	0.72 (0.18)
G-41-02-OS	**12** (2.4)	**5.3** (1.1)	-0.29 (0.77)	**0.26** (0.063)	**5.9** (1.2)	3.2 (0.87)	**0.77** (0.18)
BG-OS (9)	**8.0** (1.7)	0.0009 (0.007)	-0.13 (0.52)	0.0005 (0.0039)	0.0025 (0.0047)	4.1 (1.1)	**0.89** (0.21)
RBG-OS[3]	0.00 (0.16)	0.0025 (0.0019)	0.13 (0.54)	-0.00070 (0.0036)	0.0059 (0.0042)	2.2 (0.75)	0.39 (0.18)
RSRL-OS[4]	0.50	0.051	0.24	0.013	0.068	12	0.76

[1]Sample locations shown in Figure 2, and BG = background (south and upwind of LANL). Sample type: OS is overstory vegetation (trees).

[2] Concentration for ^{3}H is based on moisture in vegetation.

[3]RBG-OS is the regional background overstory vegetation samples collected from Embudo, Cochiti, and Jemez in 2002 (Fresquez et al., 2003).

[4]Regional Statistical Reference Level; this is the upper (95%) level background concentration (mean + 2 std dev) for overstory samples collected from Embudo, Cochiti, Jemez, Bandelier, Española, and Santa Fe from 1998–2002.

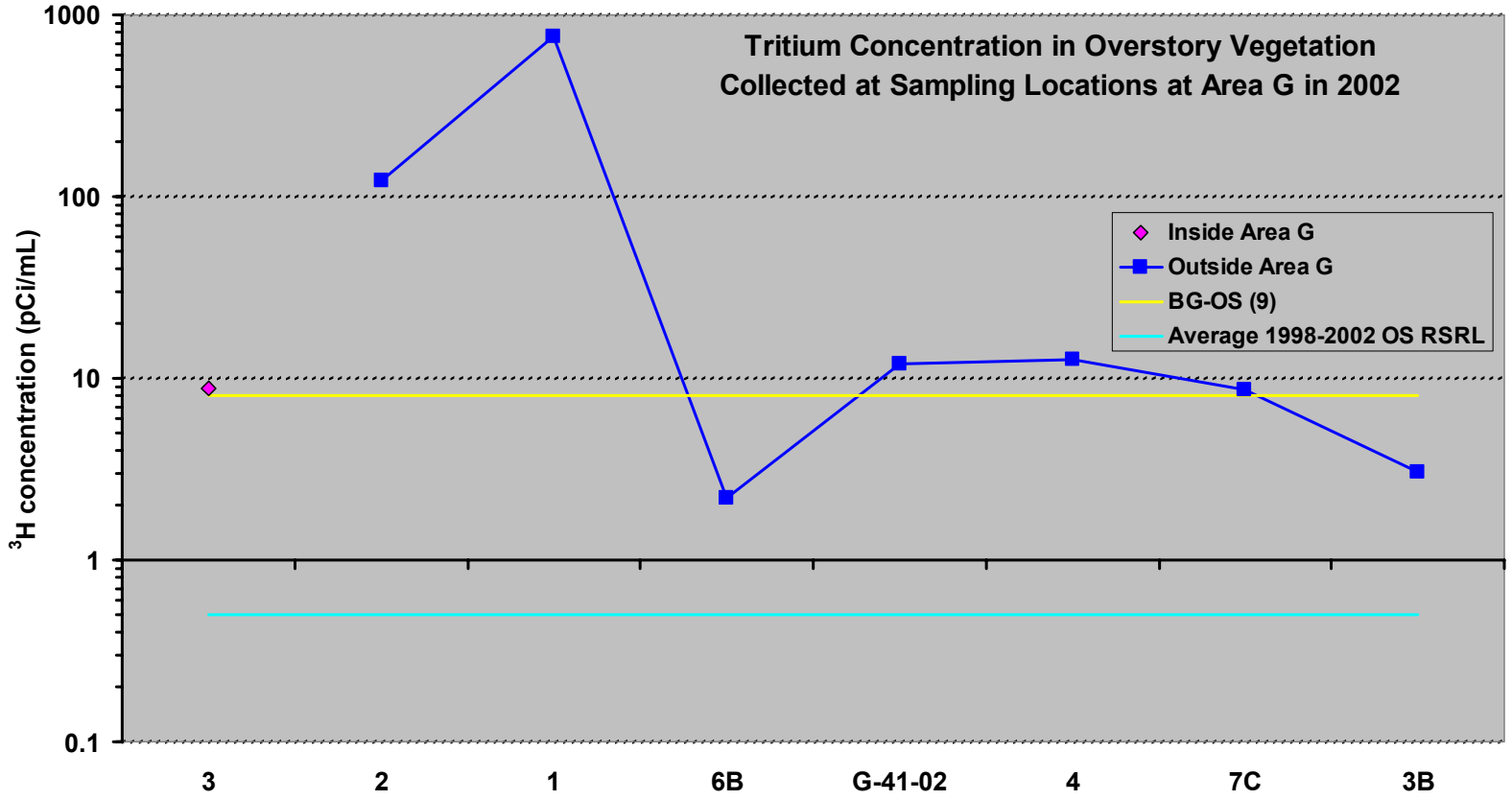

Figure 12. Concentrations of ^{3}H in overstory samples collected at Area G in 2002.

Area G immediately north and east of the TRU waste pad, at locations 4 and G-41-02, respectively, exhibited ^{3}H concentrations that were only slightly elevated over RSRL ^{3}H concentrations. An analysis of how these concentrations are changing with time will be presented in the next sections of this report.

The concentrations of ^{241}Am in the overstory samples collected at Area G (excluding samples collected at sampling location 8 and 9) ranged from 0.011 to 5.3 pCi/g ash (Table 5, Figure 13). Just as with ^{3}H concentrations, ^{241}Am concentrations in vegetation samples collected at stations G-41-02 and 4, adjacent to the TRU waste pads, were greater than both the TPU and RSRL values (Table 5). These samples also exhibited the largest concentrations found in vegetation samples in 2002; similar results were found in 1999 and 2001 (Nyhan et al., 2000, 2002).

Plutonium concentrations in plants (excluding samples collected at sampling locations 8 and 9; see Table 5, Figures 14 and 15) ranged from undetectable to 0.26 for ^{238}Pu and from 0.029 to 5.9 pCi/g ash for $^{239,240}Pu$. The plutonium concentrations of overstory samples collected on the northeastern perimeter of Area G from locations 6B, G-41-02, and 4 were equal to or greater than both the TPU and RSRL values (bold values in Table 5). These data correlated well with the results for ^{241}Am, as well as the elevated soil plutonium concentrations presented previously (Table 5, Figure 6), which was to be expected since the samples were collected near the TRU pads.

Most of the concentrations of ^{137}Cs, ^{90}Sr, and ^{tot}U found in the overstory vegetation samples collected at Area G were less than both the TPU (99% confidence level) and RSRL values (bold values in Table 5), similar to the results exhibited by the soil samples (Table 5).

4. SAMPLING DATA COLLECTED SINCE 1980 AT AREA G AND STATISTICAL ANALYSIS OF DATA FOR TRENDS WITH TIME

a. Overview

The radionuclide data for 17 soil and 11 vegetation sampling campaigns (described in Tables 2 and 3; shown in Figure 5; listed in Appendices D, E, and F) were assembled and compared with radionuclide RSRL and SAL values. The radionuclide values were then plotted as

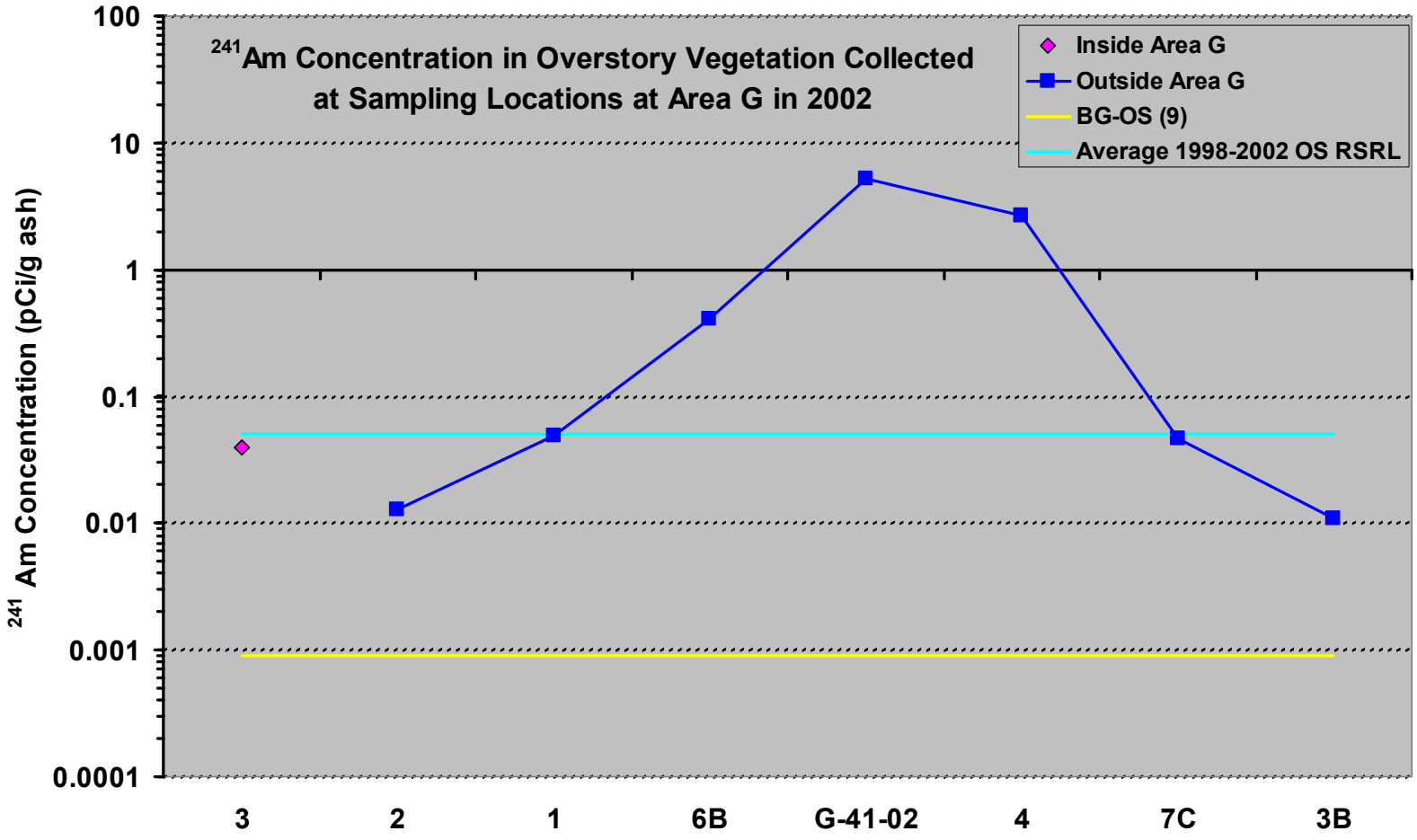

Figure 13. Concentrations of ^{241}Am in overstory samples collected at Area G in 2002.

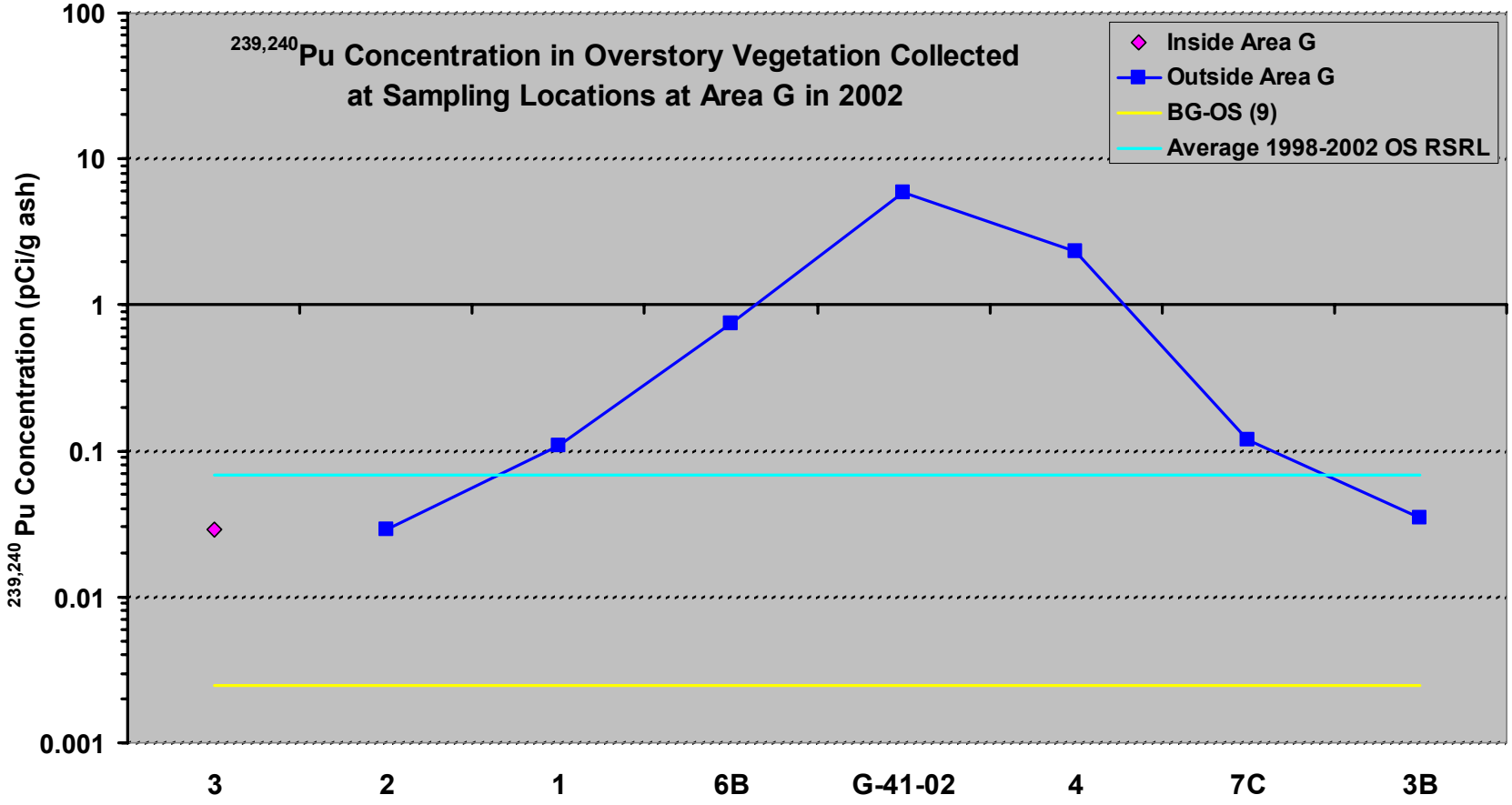

Figure 14. Concentrations of ^{239,240}Pu in overstory samples collected at Area G in 2002.

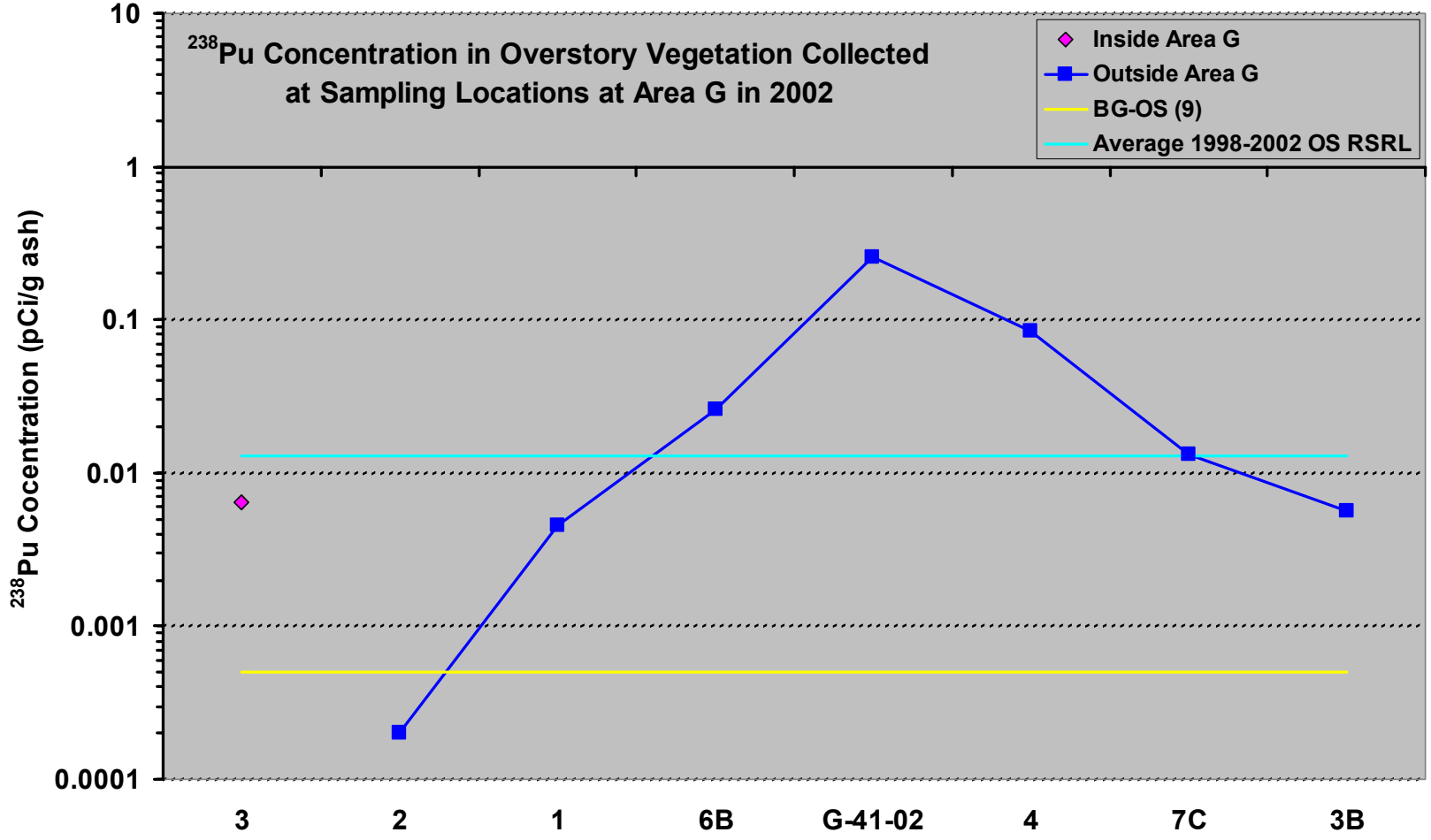

Figure 15. Concentrations of ^{238}Pu in overstory samples collected at Area G in 2002.

a function of time and location around and inside of Area G. Since the waste use history of Area G varied spatially with time over this large area, soil and vegetation samples from the various sampling campaigns were analyzed as a function of their counterclockwise distance around the perimeter of Area G, and were segregated into various groupings of radionuclide data. Besides the group of samples collected inside of Area G, four perimeter groups were arbitrarily defined, as illustrated in Figure 3:

(1) Southwestern perimeter (sample locations 8 through 30-01)
(2) Southern perimeter (sample locations 30-01 through 36-02)
(3) Eastern perimeter (sample locations 36-01 through G-13 and 42-01), and
(4) Northern perimeter (sample locations 1,1 through 60-01).

Radionuclide concentrations in overstory and understory vegetation samples were maintained as separate databases. Since there were fewer vegetation samples collected with time than soil samples, each of these two databases could only be grouped into samples collected both along the external perimeter of Area G (adjacent to the fence) and inside of Area G.

An overview of both of the vegetation data bases and the soils data base is presented in Table 6 to give the reader a sense of the properties of each

Table 6. Total Number of Samples and Number of Samples with Radionuclide Concentrations Equal to or Greater Than RSRL Concentrations in Data Sets used in Statistical Trend Analysis at Area G (sample data from locations 8 and 9 omitted).

Case Number	Sample Type[1]	Sample Location	Radionuclide	Total number of samples	Number of samples ≥ RSRL	% of samples ≥ RSRL
1	OS	Perimeter	^{3}H	53	41	77
2	OS	Inside Area G	^{3}H	10	8	80
3	OS	Perimeter	^{241}Am	27	12	44
4	OS	Inside Area G	^{241}Am	6	3	50
5	OS	Perimeter	^{238}Pu	50	9	18
6	OS	Inside Area G	^{238}Pu	8	8	100
7	OS	Perimeter	$^{239,240}Pu$	55	20	36
8	OS	Inside Area G	$^{239,240}Pu$	10	5	50
9	OS	Perimeter	^{tot}U	33	2	6.1
10	OS	Inside Area G	^{tot}U	8	6	75
11	US	Perimeter	^{3}H	49	33	67

Table 6 (cont.)

Case Number	Sample Type[1]	Sample Location	Radionuclide	Total number of samples	Number of samples ≥ RSRL	% of samples ≥ RSRL
12	US	Inside Area G	^{3}H	35	32	91
13	US	Perimeter	^{241}Am	20	13	65
14	US	Inside Area G	^{241}Am	17	8	47
15	US	Perimeter	^{238}Pu	38	18	47
16	US	Inside Area G	^{238}Pu	24	9	38
17	US	Perimeter	$^{239,240}Pu$	45	30	67
18	US	Inside Area G	$^{239,240}Pu$	35	22	63
19	US	Perimeter	^{tot}U	33	2	6
20	US	Inside Area G	^{tot}U	26	0	0
21	Soil	Southwestern perimeter	^{3}H	112	81	72
22	Soil	Southern perimeter	^{3}H	71	55	77
23	Soil	Eastern perimeter	^{3}H	69	52	75
24	Soil	Northern perimeter	^{3}H	178	143	80
25	Soil	Inside	^{3}H	66	58	88
26	Soil	Southwestern perimeter	^{241}Am	100	59	59
27	Soil	Southern perimeter	^{241}Am	66	50	76
28	Soil	Eastern perimeter	^{241}Am	62	58	94
29	Soil	Northern perimeter	^{241}Am	174	145	83
30	Soil	Inside	^{241}Am	55	39	71
31	Soil	Southwestern perimeter	^{238}Pu	118	54	46
32	Soil	Southern perimeter	^{238}Pu	71	32	45
33	Soil	Eastern perimeter	^{238}Pu	66	64	97
34	Soil	Northern perimeter	^{238}Pu	178	157	88
35	Soil	Inside	^{238}Pu	59	38	64
36	Soil	Southwestern perimeter	$^{239,240}Pu$	120	57	48
37	Soil	Southern perimeter	$^{239,240}Pu$	72	42	58
38	Soil	Eastern perimeter	$^{239,240}Pu$	69	61	88
39	Soil	Northern perimeter	$^{239,240}Pu$	180	157	87
40	Soil	Inside	$^{239,240}Pu$	66	45	68
41	Soil	Southwestern perimeter	^{tot}U	88	47	53
42	Soil	Southern perimeter	^{tot}U	43	19	44
43	Soil	Eastern perimeter	^{tot}U	38	18	47
44	Soil	Northern perimeter	^{tot}U	103	38	37
45	Soil	Inside	^{tot}U	49	24	49

[1] OS and US indicate Overstory and Understory vegetation sample, respectively.

portion of the data bases, as well as the proportion of samples that were less than or equal to RSRL values.

Two radionuclides, ^{137}Cs and ^{90}Sr, were not included in this analysis due to infrequent analysis of these radionuclides and to the fact that very low concentrations were observed when assays were performed. The final steps in the analysis of the data for all of the other radionuclides were to determine statistically whether these radionuclide concentrations were normally distributed or not, and then to determine whether they were increasing or decreasing with time (see description in Methods section). This final trend analysis is presented in Table 7.

b. Radionuclide Concentrations in Soils

Comparing all of the data across all radionuclide assays, radionuclide concentrations in soils generally had substantially larger numbers of assays greater than RSRL concentrations than vegetation samples (Table 7). Concentrations of ^{tot}U in soils had the smallest number of samples equal to or greater than RSRL concentrations, with only 38 out of 103 total samples containing equal to or greater than RSRL concentrations of ^{tot}U (Table 7).

Concentrations of ^{3}H in soils generally exhibited the largest number of samples with equal to or greater than RSRL concentrations than any other radionuclide. The exception to this trend was the ^{238}Pu found in soils along the eastern perimeter of Area G, where 64 out of 66 samples had equal to or greater than RSRL concentrations.

Only 10 of the 25 soils-related radionuclide cases considered for the trend analysis (Table 6) exhibited statistically significant relationships with time (Table 7). The radionuclide concentrations for these 10 cases are presented as a function of time in Figures 16 through 25. Soil samples collected along the southwestern and southern perimeters of Area G exhibited concentrations of ^{3}H that increased with time. Concentrations of ^{3}H along the eastern and northern perimeters, as well as the samples collected within Area G, decreased with time (Table 7, Figures 16 through 20); this agrees with similar trends found previously for samples collected from 1974 through 1994 for an area east of TA-54 (see Table 2 in Fresquez et al., 1996b). The increases along the southwestern and southern

Table 7. Nonparametric Kendall Tau b Correlation Coefficient Results for Trend Analysis for All Soils and Vegetation Radionuclide Data Collected Since 1980 at Various Locations In and Around Area G (samples from locations 8 and 9 omitted)[1]. Bolded Values Represent Significant Trends in Radionuclide Concentrations with Time.

Sample Type/Location	Radionuclide ^{3}H	^{241}Am	^{238}Pu	$^{239,240}Pu$	^{tot}U
Soil					
Southwestern perimeter	**0.46 (U)[2]**	**-0.18 (D)**	-0.057	-0.079	**-0.28[3](D)**
Southern perimeter	**0.33 (U)**	-0.14	0.076	-0.13	**-0.39[3](D)**
Eastern perimeter	**-0.20 (D)**	0.069	-0.011	-0.021	**-0.37[3](D)**
Northern perimeter	**-0.21 (D)**	0.011	0.014	0.076	-0.028
Inside	**-0.18 (D)**	-0.017	-0.15	-0.11	**-0.56[3](D)**
Overstory vegetation					
Outside Area G	0.079	**0.29 (U)**	**-0.33 (D)**	**-0.26 (D)**	**-0.34 (D)**
Inside of Area G	-0.13[3]	-0.067	-0.36	-0.22	**-0.86[3](D)**
Understory vegetation					
Outside Area G	0.19	-0.15	**-0.26 (D)**	**-0.49 (D)**	-0.19
Inside of Area G	-0.21	-0.27	**-0.32 (D)**	**-0.53 (D)**	-0.11[3]

[1]Results represent statistical analysis of the 45 groups of data (cases) described in Table 6.

[2](U) = upward trend, (D) = downward trend; significant at the 95% confidence interval at a minimum – many correlations significant at the 99% confidence interval.

[3]The radionuclide concentration data in these data sets were found to be normally distributed using a Shapiro-Wilk Test for Normality, so these numbers represent parametric Pearson correlation coefficients.

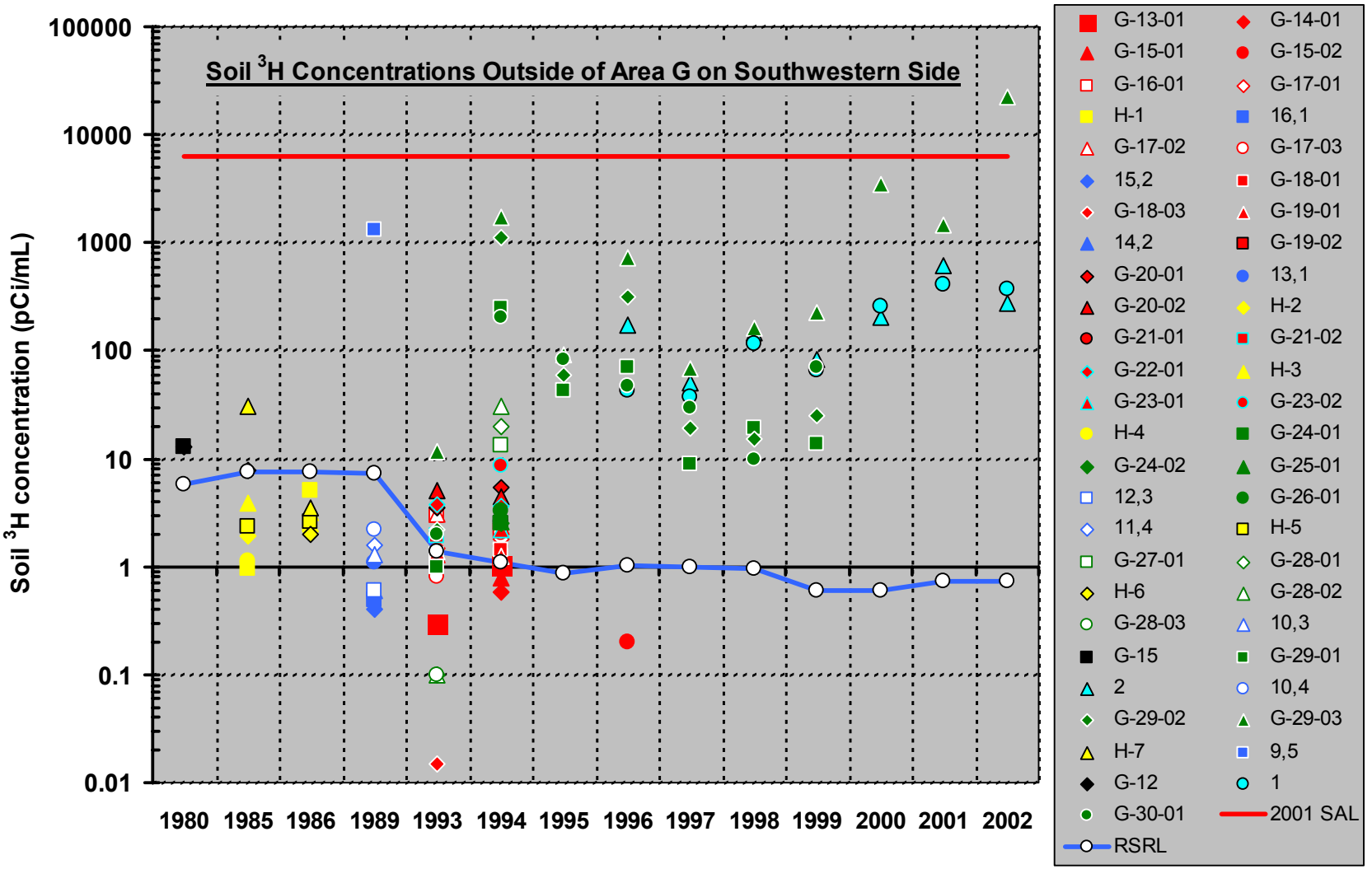

Figure 16. ^{3}H concentrations in soil samples collected on the southwestern perimeter of Area G from 1980 to 2002 showing an upward trend with time (see Table 7).

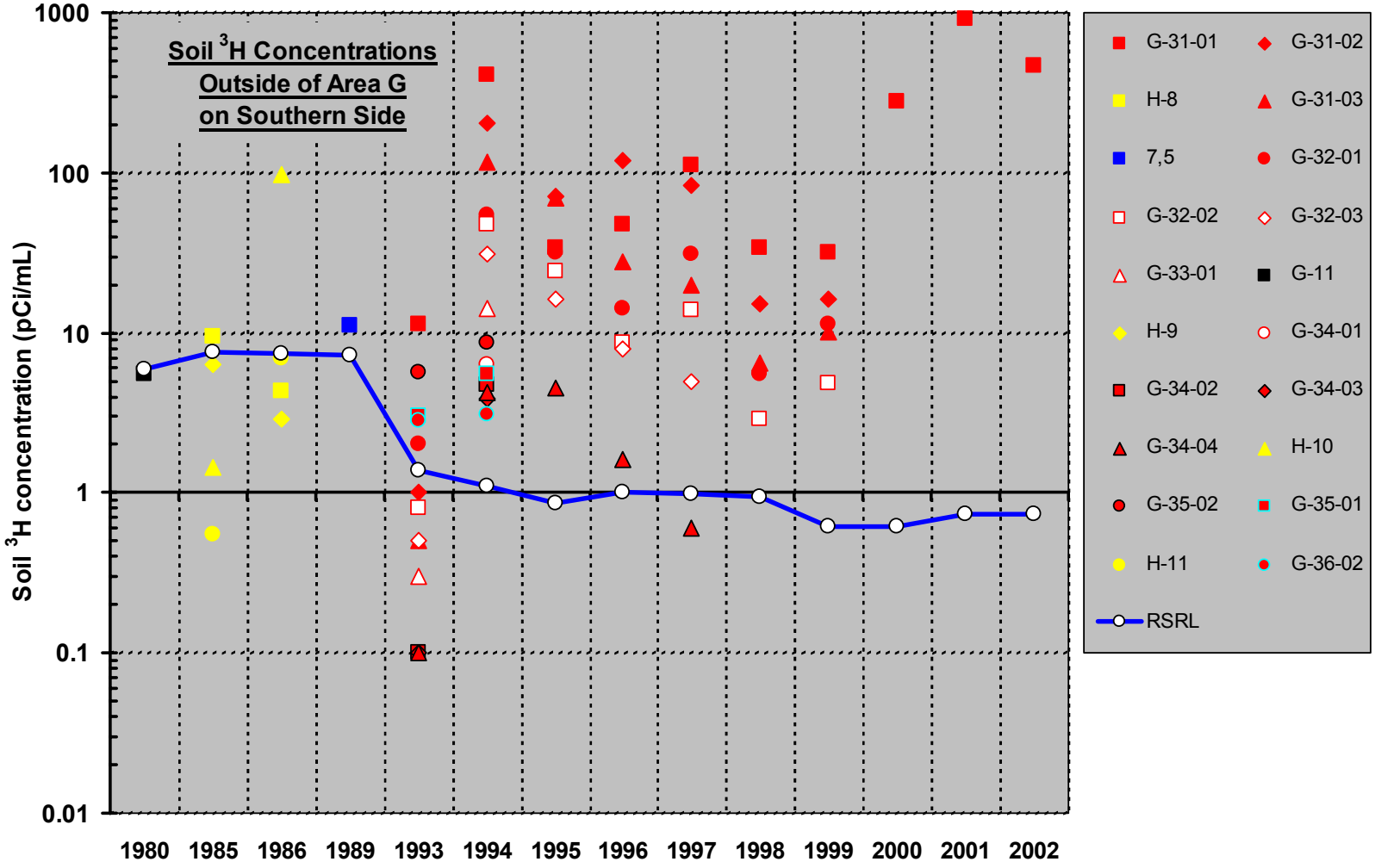

Figure 17. ^{3}H concentrations in soil samples collected on the southern perimeter of Area G from 1980 to 2002 showing an upward trend with time (see Table 7).

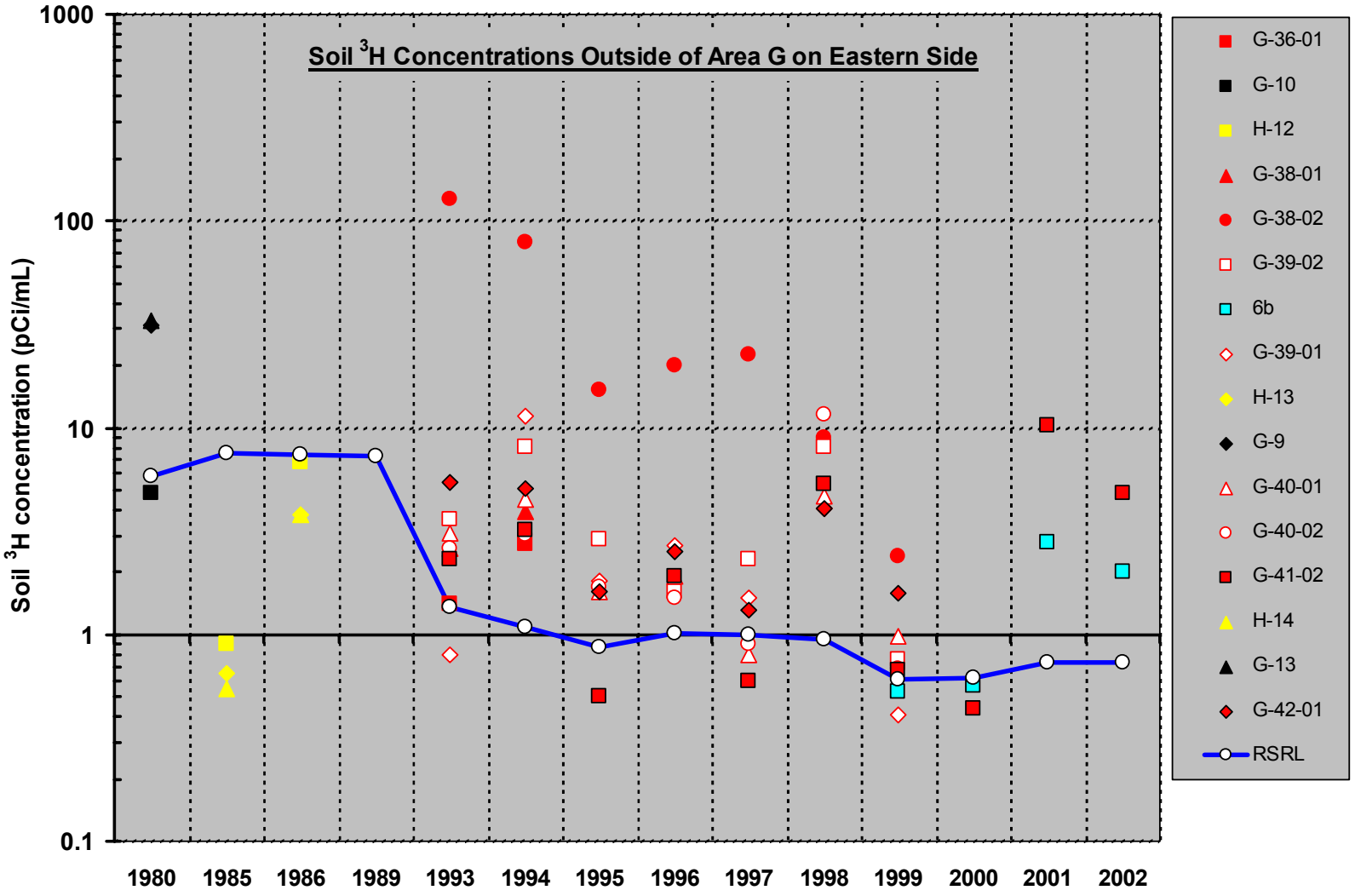

Figure 18. ^{3}H concentrations in soil samples collected on the eastern perimeter of Area G from 1980 to 2002 showing a downward trend with time (see Table 7).

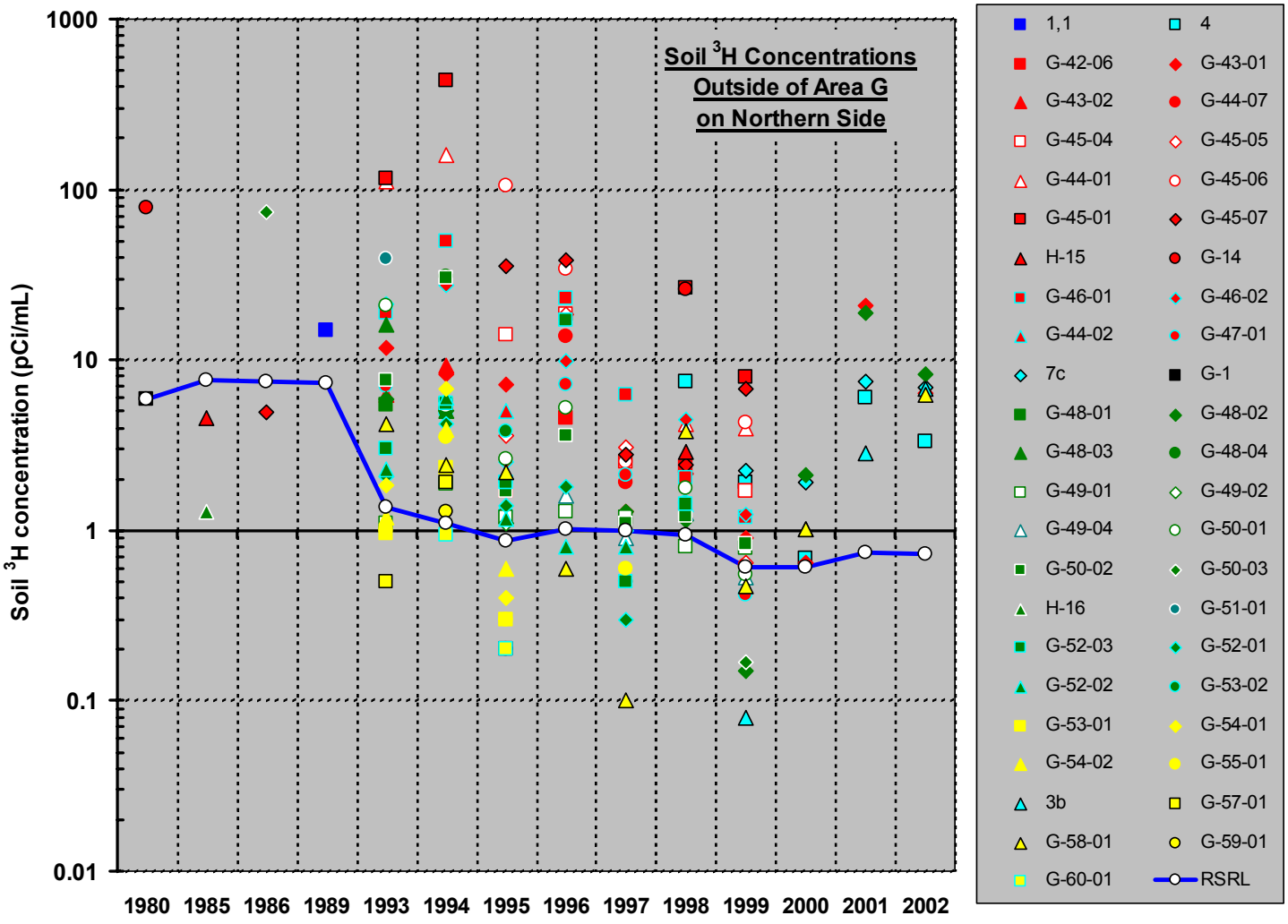

Figure 19. ^{3}H concentrations in soil samples collected on the northern perimeter of Area G from 1980 to 2002 showing a downward trend with time (see Table 7).

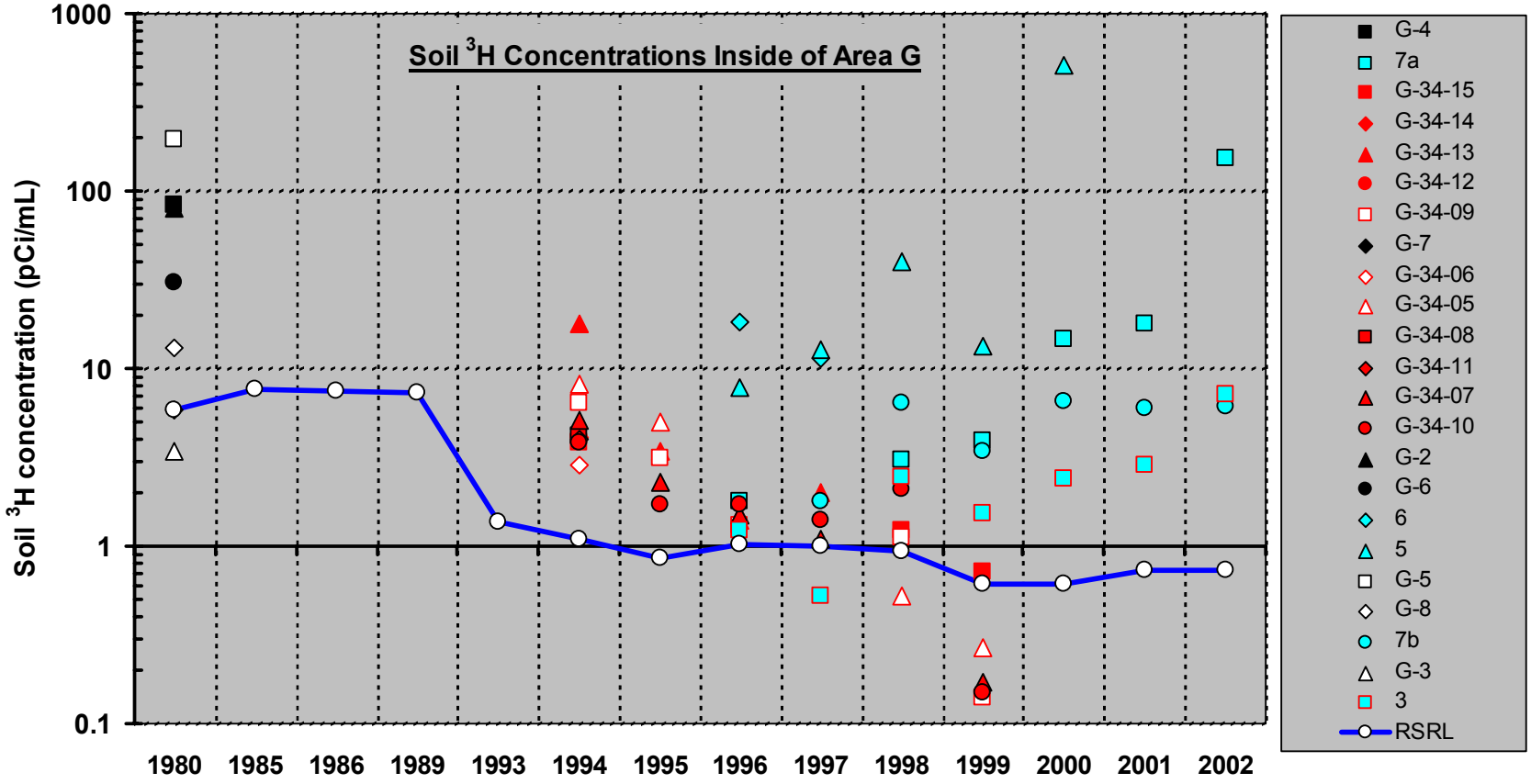

Figure 20. ^{3}H concentrations in soil samples collected inside of Area G from 1980 to 2002 showing a downward trend with time (see Table 7).

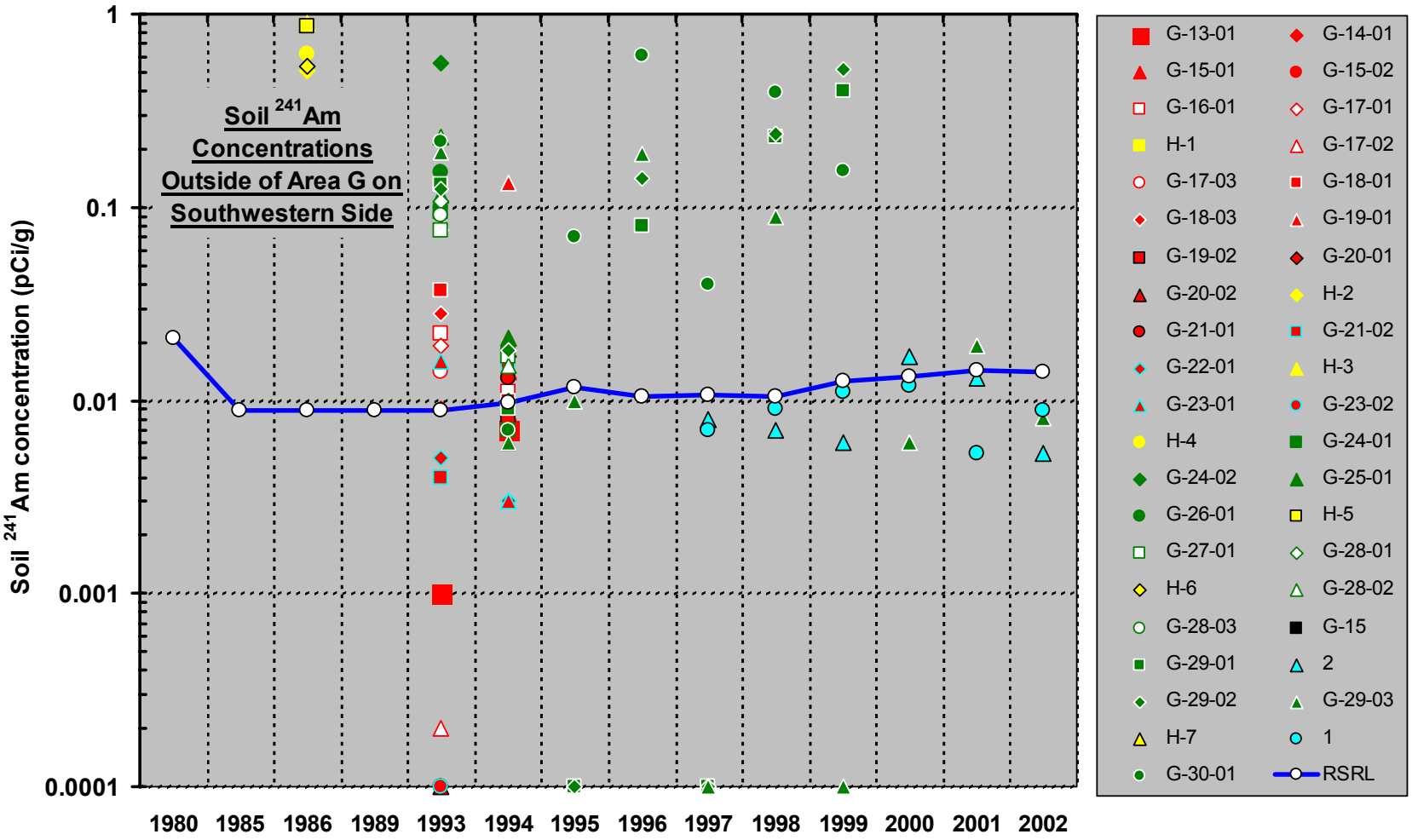

Figure 21. Concentrations of ^{241}Am in soil samples collected on the southwestern perimeter of Area G from 1980 to 2002 showing a downward trend with time (see Table 7).

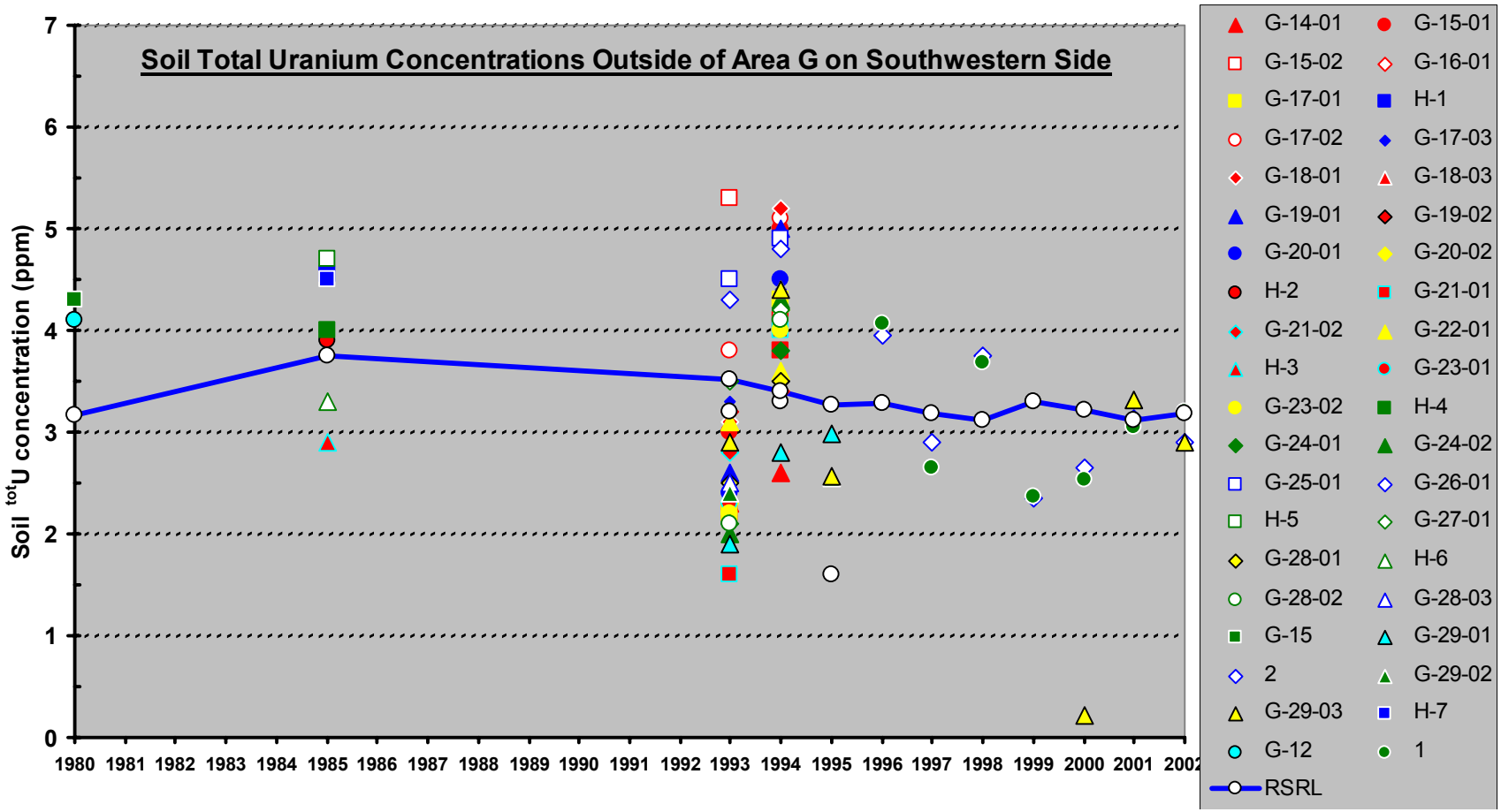

Figure 22. Concentrations of ^{tot}U in soil samples collected on the southwestern perimeter of Area G from 1980 to 2002 showing a downward trend with time (see Table 7).

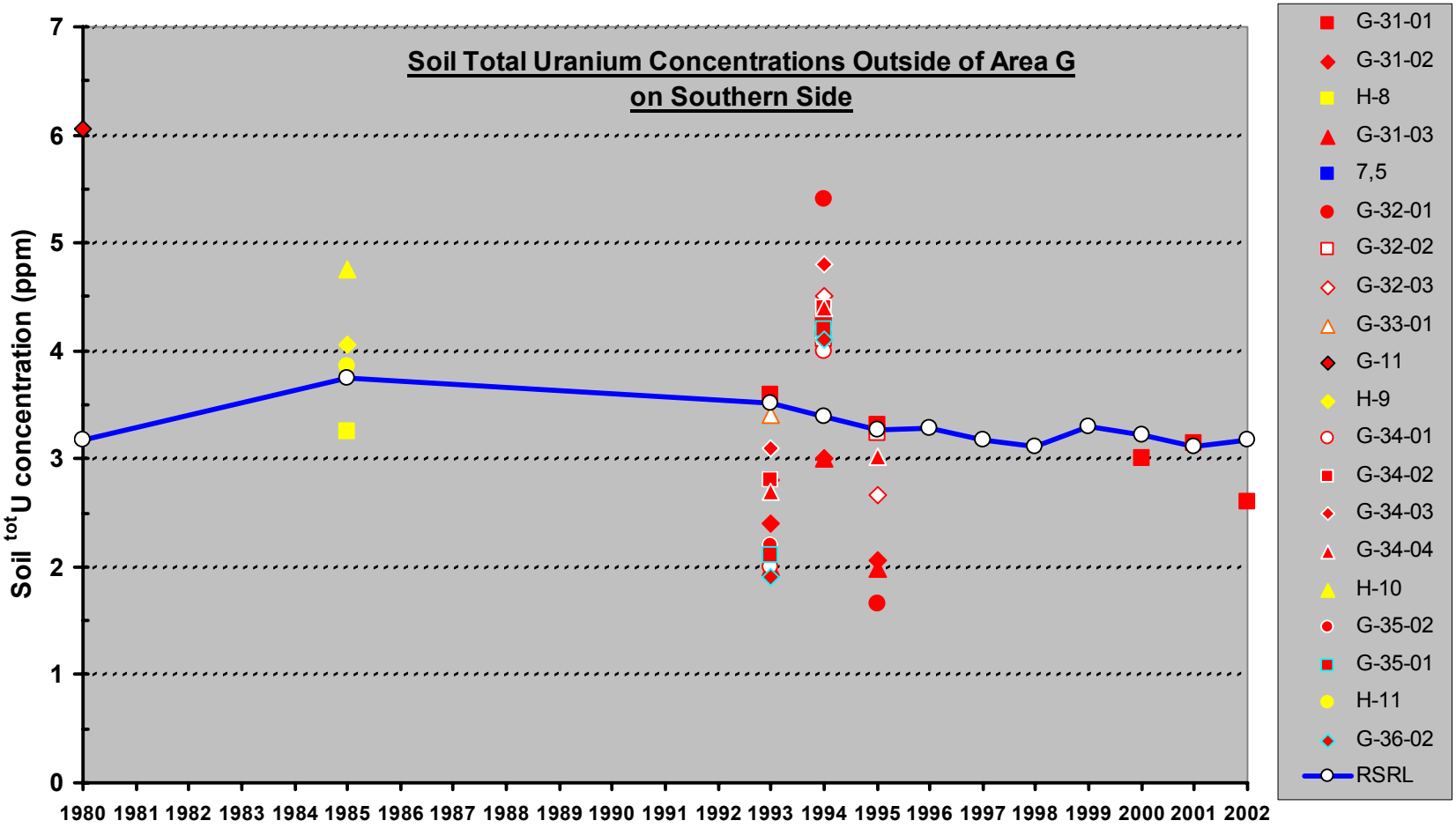

Figure 23. Concentrations of ^{tot}U in soil samples collected on the southern perimeter of Area G from 1980 to 2002 showing a downward trend with time (see Table 7).

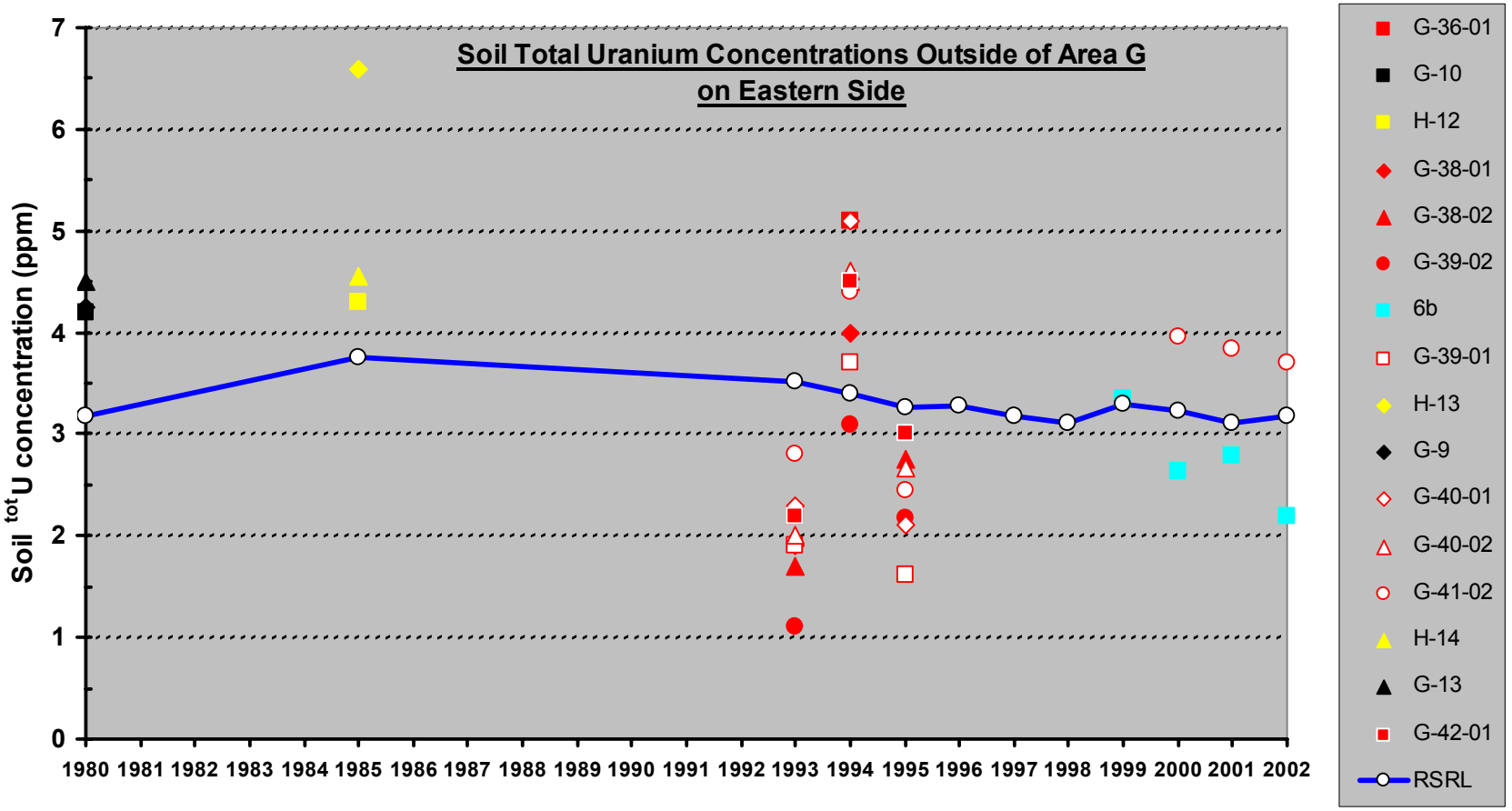

Figure 24. Concentrations of ^{tot}U in soil samples collected on the eastern perimeter of Area G from 1980 to 2002 showing a downward trend with time (see Table 7).

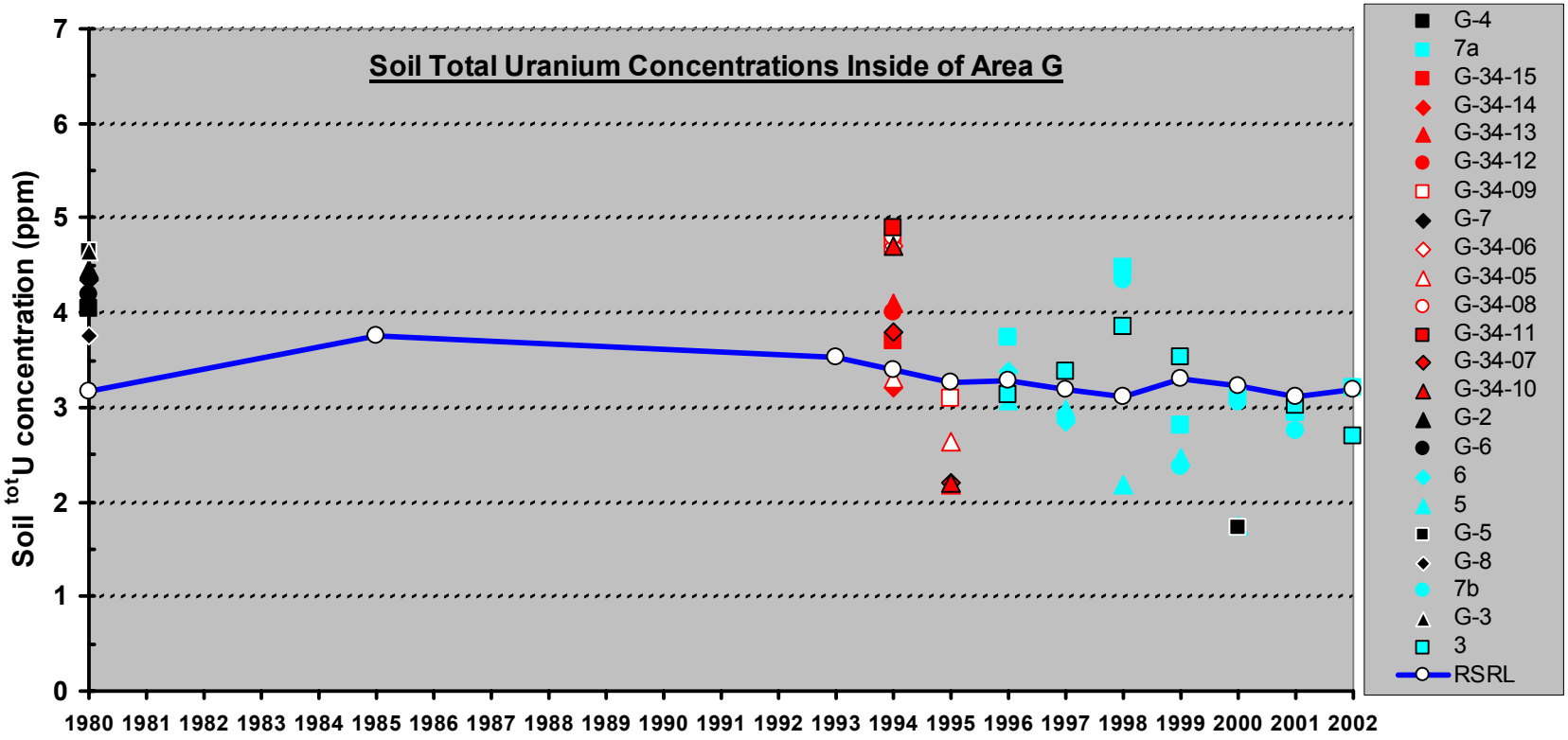

Figure 25. Concentrations of ^{tot}U in soil samples collected inside of Area G from 1980 to 2002 showing a downward trend with time (see Table 7).

perimeters are no doubt due to ^{3}H coming from the ^{3}H shafts located adjacent to the southwestern border of Area G (Figure 2). Most of the soil ^{3}H concentrations in all of these five cases represent concentrations that are equal to or greater than RSRL concentrations.

Soil ^{241}Am concentrations decreased with time along the southwestern perimeter of Area G (Table 7, Figure 21). The reason for this correlation is unclear at this time, but probably is not related to current waste practices at Area G. No other significant trends were observed in the other regions on the perimeter and within Area G.

No significant trends with time were detected with the soil plutonium isotopes (Table 7). This does not agree with the soil plutonium data trends found previously for samples collected from 1974 through 1994 for an area east of TA-54 (see Table 2 in Fresquez et al., 1996b). The latter study found soil ^{238}Pu and $^{239,240}Pu$ concentrations to be significantly increasing and decreasing, respectively. It is entirely possible that one location like this could exhibit different results compared with the results of all of the sampling locations in the current study, as well as the fact that the two studies involved different sampling periods.

Concentrations of soil ^{tot}U significantly decreased with time along the southwestern, southern, and eastern perimeters of Area G, as well as within Area G (Table 7, Figures 22 through 25). Soil ^{tot}U concentrations were also found to decrease with time for an area east of TA-54 (Fresquez et al., 1996b). Interestingly enough, these trends were observed in spite of the fact that only 45% of the samples assayed from these four areas around and within Area G had equal to or greater than RSRL concentrations of ^{tot}U (Table 7). When we reran the statistical trend analysis using a data set with only equal to or greater than RSRL concentrations, we found that soil ^{tot}U concentrations uniformly and significantly decreased with time for the soil samples from the southwestern and northern perimeters of Area G, as well as within Area G.

c. Radionuclide Concentrations in Plants

When all of the radionuclide data were compared across all vegetation samples, radionuclide concentrations in understory samples generally had fewer numbers of assays equal to or greater

than RSRL concentrations than overstory samples (Table 7). Just as with the soil radionuclide data, concentrations of ^{tot}U in overstory and understory vegetation normally had the smallest number of samples equal to or greater than RSRL concentrations, both on the perimeter and within Area G (Table 7). About 91% of the understory samples collected inside of Area G had samples equal to or greater than RSRL concentrations of ^{3}H; this value was only 54% for perimeter understory vegetation samples (Table 7).

Similar to the soils data trend, the ^{238}Pu found in overstory samples collected within Area G was consistently equal to or greater than RSRL concentrations, where eight out of eight samples had equal to or greater than RSRL concentrations. This case was the exception however, since only 9 of 63 overstory samples collected along the Area G perimeter contained equal to or greater than RSRL concentrations (Table 7).

Also similar to the trend analysis for the soil radionuclides, 9 of the 20 vegetation-related radionuclide cases considered for the trend analysis (Table 7) exhibited statistically significant relationships with time (Table 7). The radionuclide concentrations for these nine cases are presented as a function of time in Figures 26 through 34.

Unlike the relationships found with soil ^{3}H along the perimeters of Area G and within Area G, no significant trends were found for ^{3}H in overstory and understory vegetation (Table 7). This is an unexpected observation, especially since rather large proportions of the samples collected contained equal to or greater than RSRL concentrations of ^{3}H (Table 7) and the fact that ^{3}H is so mobile and easily taken up from soils by vegetation. The reason for this finding is unclear at this time, but may have to do with the way the data were analyzed: if more plant sample radionuclide data had existed for just the southwestern portion of Area G (and grouped similar to how the soil samples were grouped), perhaps a positive trend would have been observed for ^{3}H in vegetation also.

Overstory samples collected along the perimeter of Area G exhibited concentrations of ^{241}Am that increased with time (Table 7, Figure 26). This is just the opposite trend as found with soil ^{241}Am concentrations along the southwestern perimeter of Area G (Table 7). A similar result was not found with overstory samples collected inside of Area G, as well as with understory

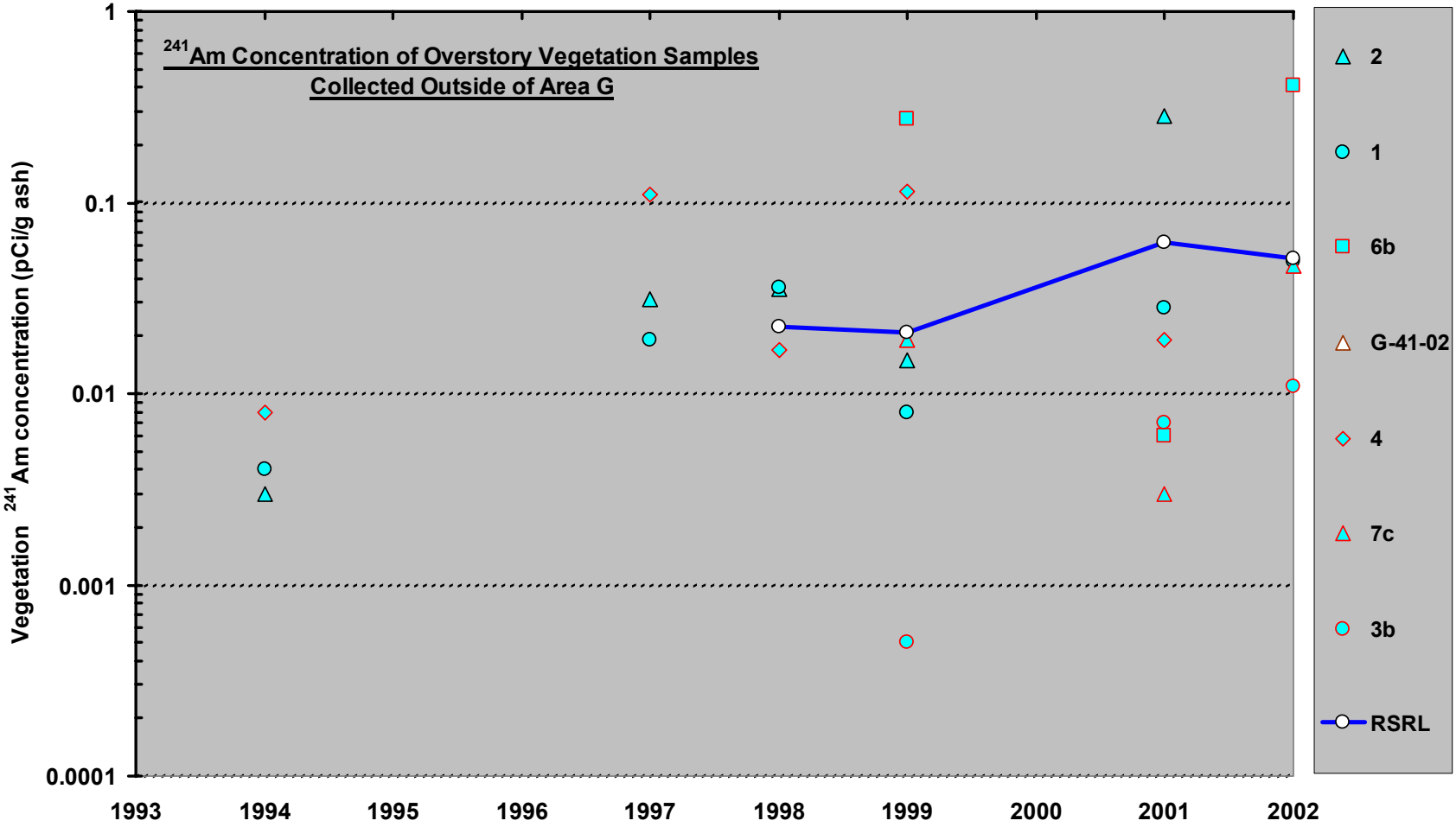

Figure 26. Concentrations of ^{241}Am in overstory samples collected outside of Area G from 1994 to 2002 showing an upward trend with time (see Table 7).

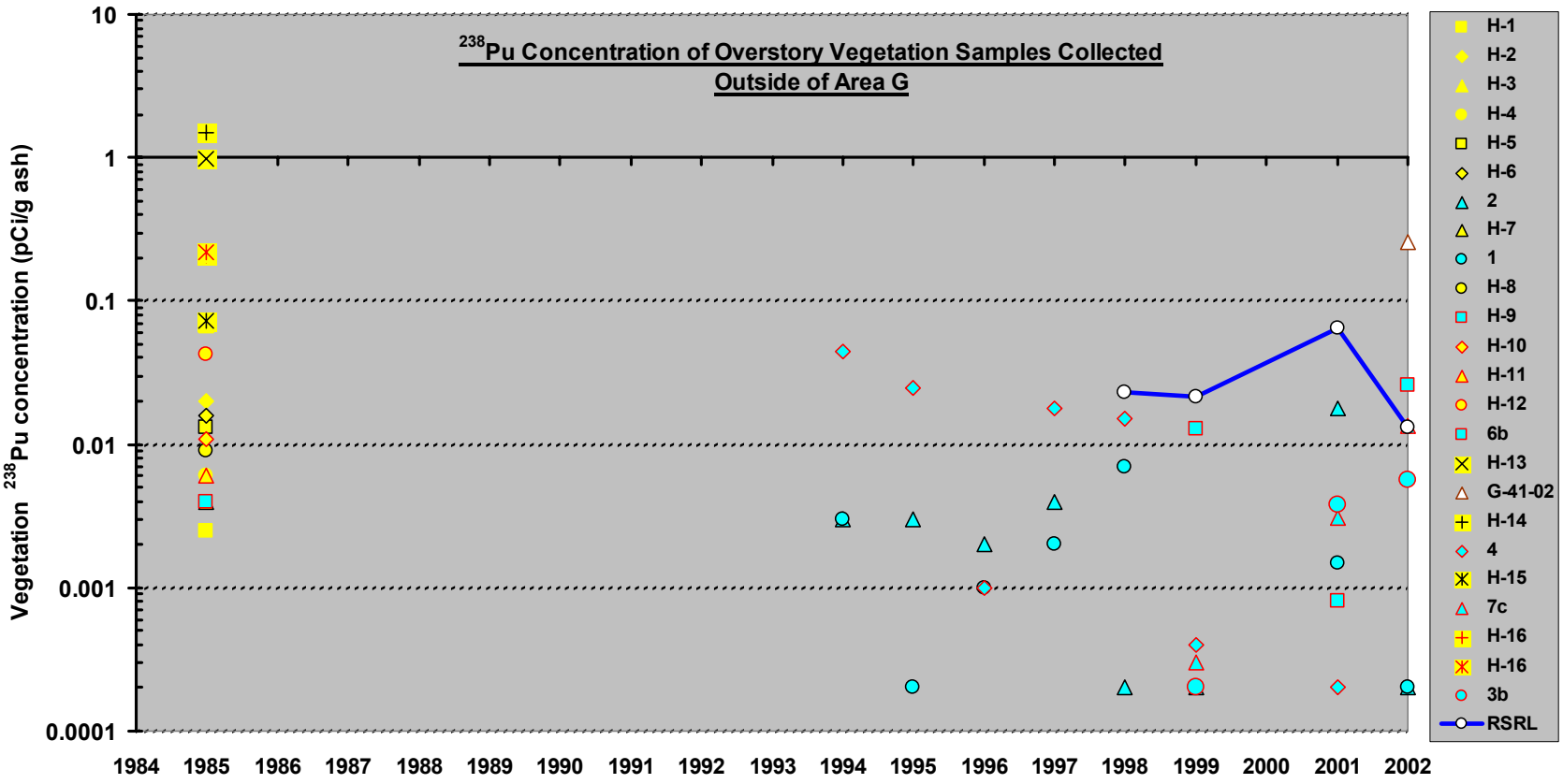

Figure 27. Concentrations of ^{238}Pu in overstory samples collected outside of Area G from 1985 to 2002 showing a downward trend with time (see Table 7).

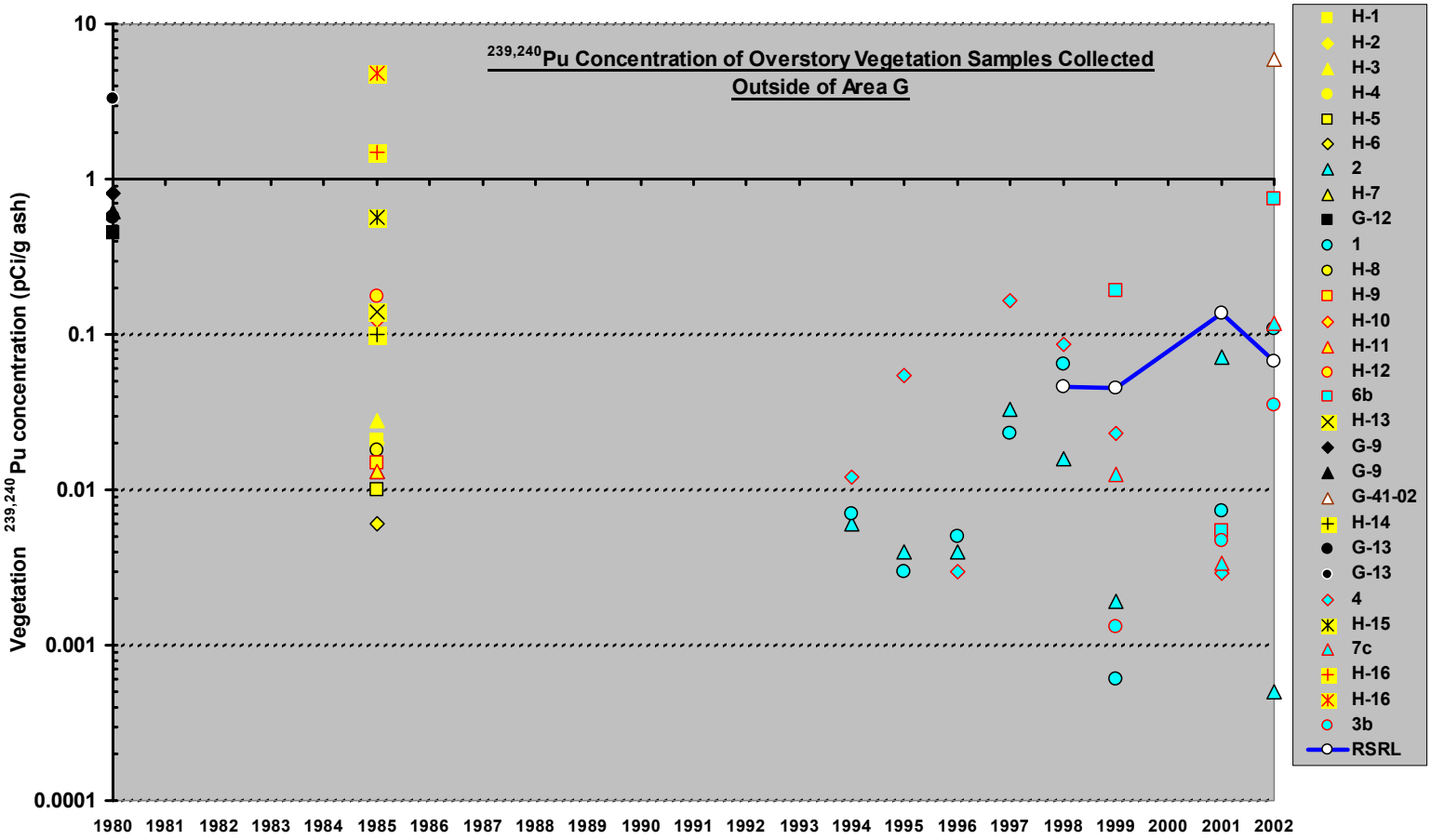

Figure 28. Concentrations of ^{239,240}Pu in overstory samples collected outside of Area G from 1980 to 2002 showing a downward trend with time (see Table 7).

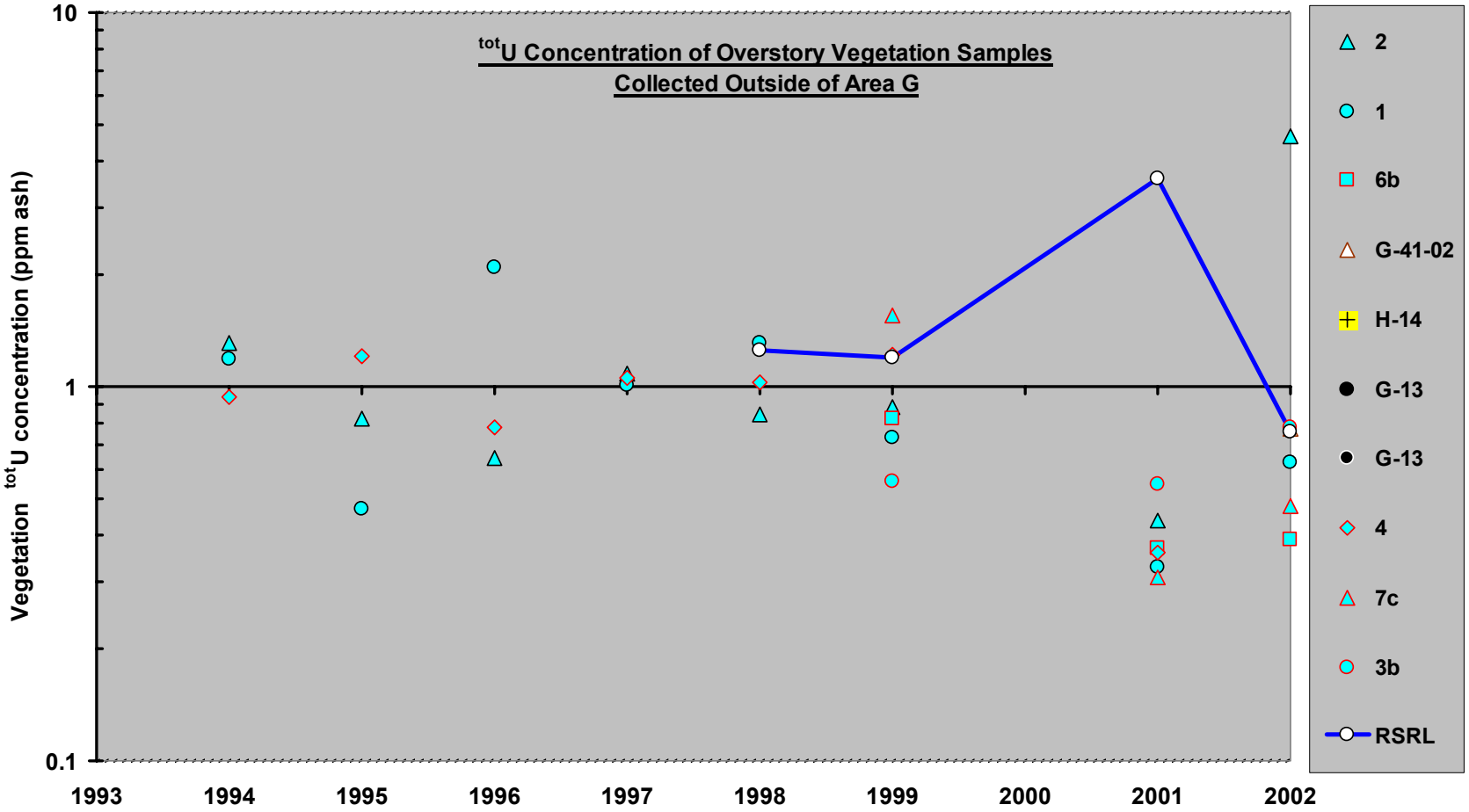

Figure 29. Concentrations of ^{tot}U in overstory samples collected outside of Area G from 1994 to 2002 showing a downward trend with time (see Table 7).

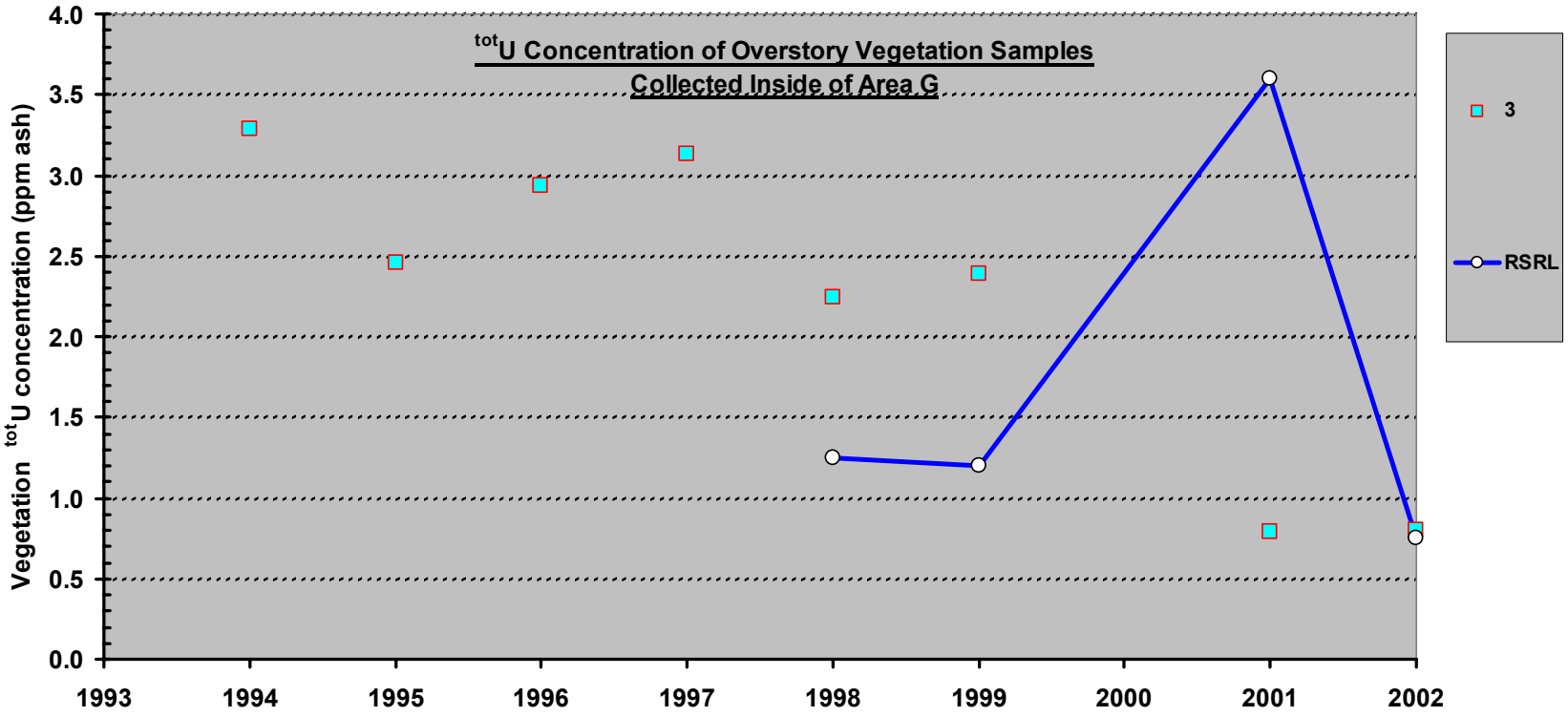

Figure 30. Concentrations of ^{tot}U in overstory samples collected inside of Area G from 1994 to 2002 showing a downward trend with time (see Table 7).

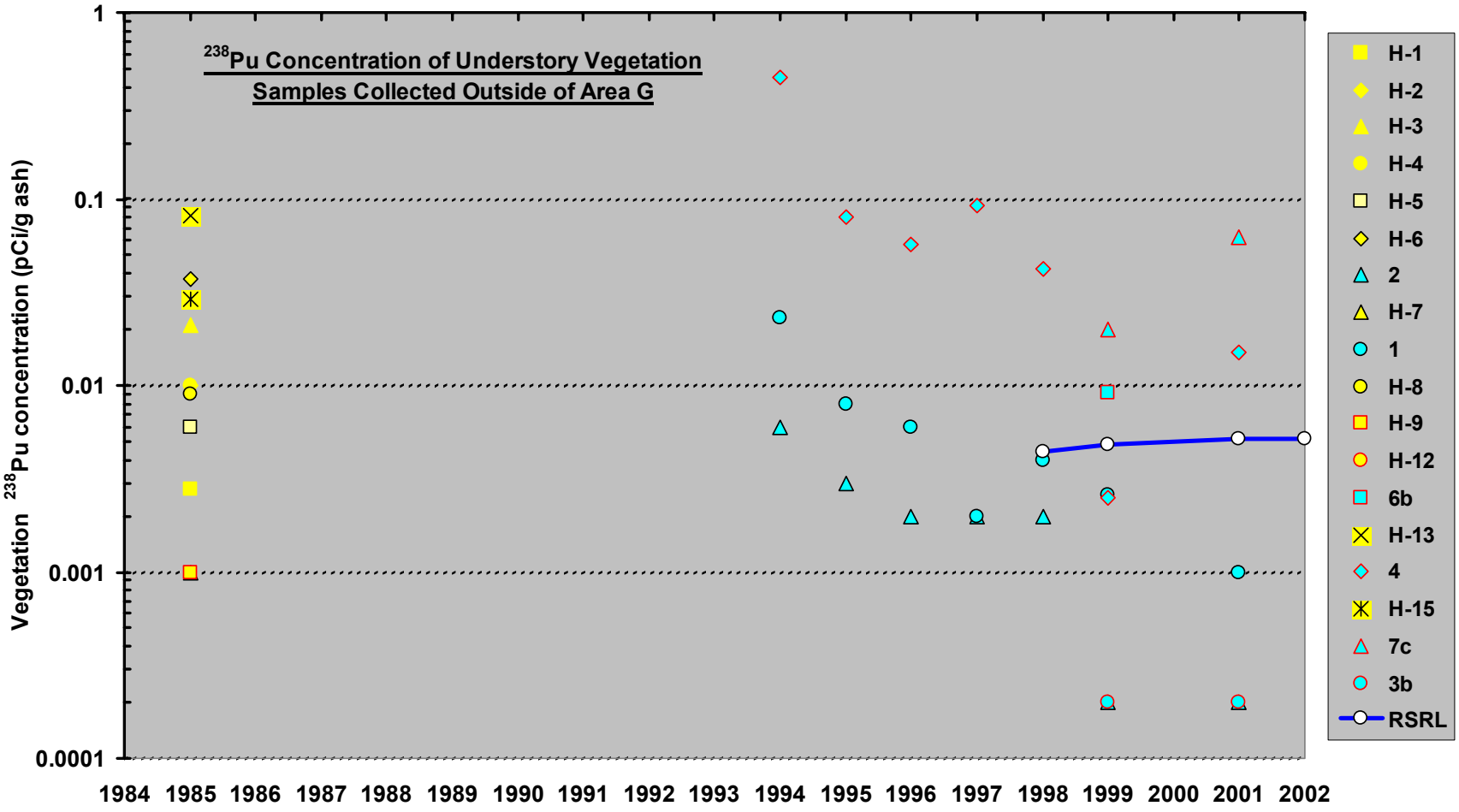

Figure 31. Concentrations of ^{238}Pu in understory samples collected outside of Area G from 1985 to 2002 showing a downward trend with time (see Table 7).

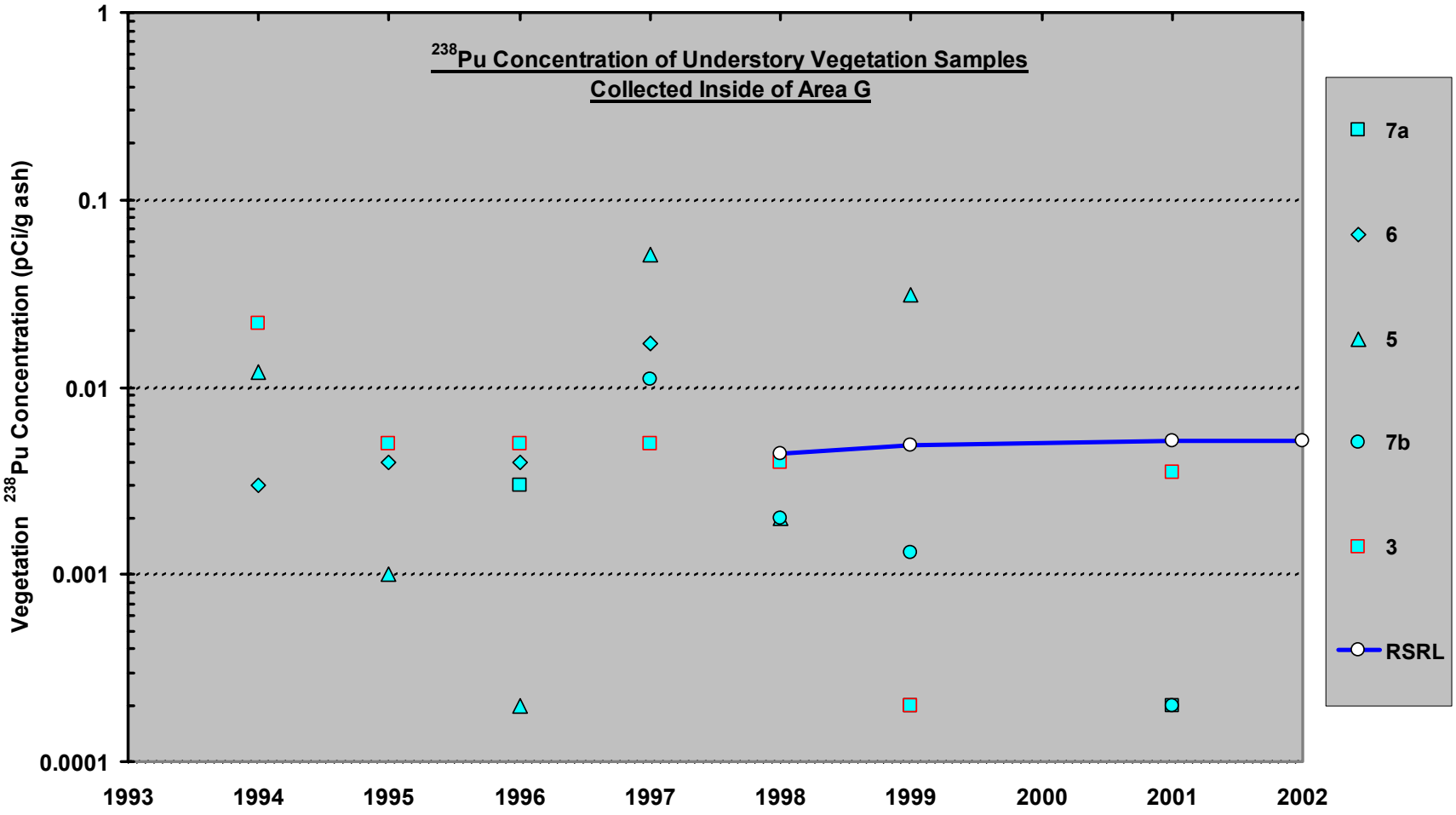

Figure 32. Concentrations of ^{238}Pu in understory samples collected inside of Area G from 1994 to 2002 showing a downward trend with time (see Table 7).

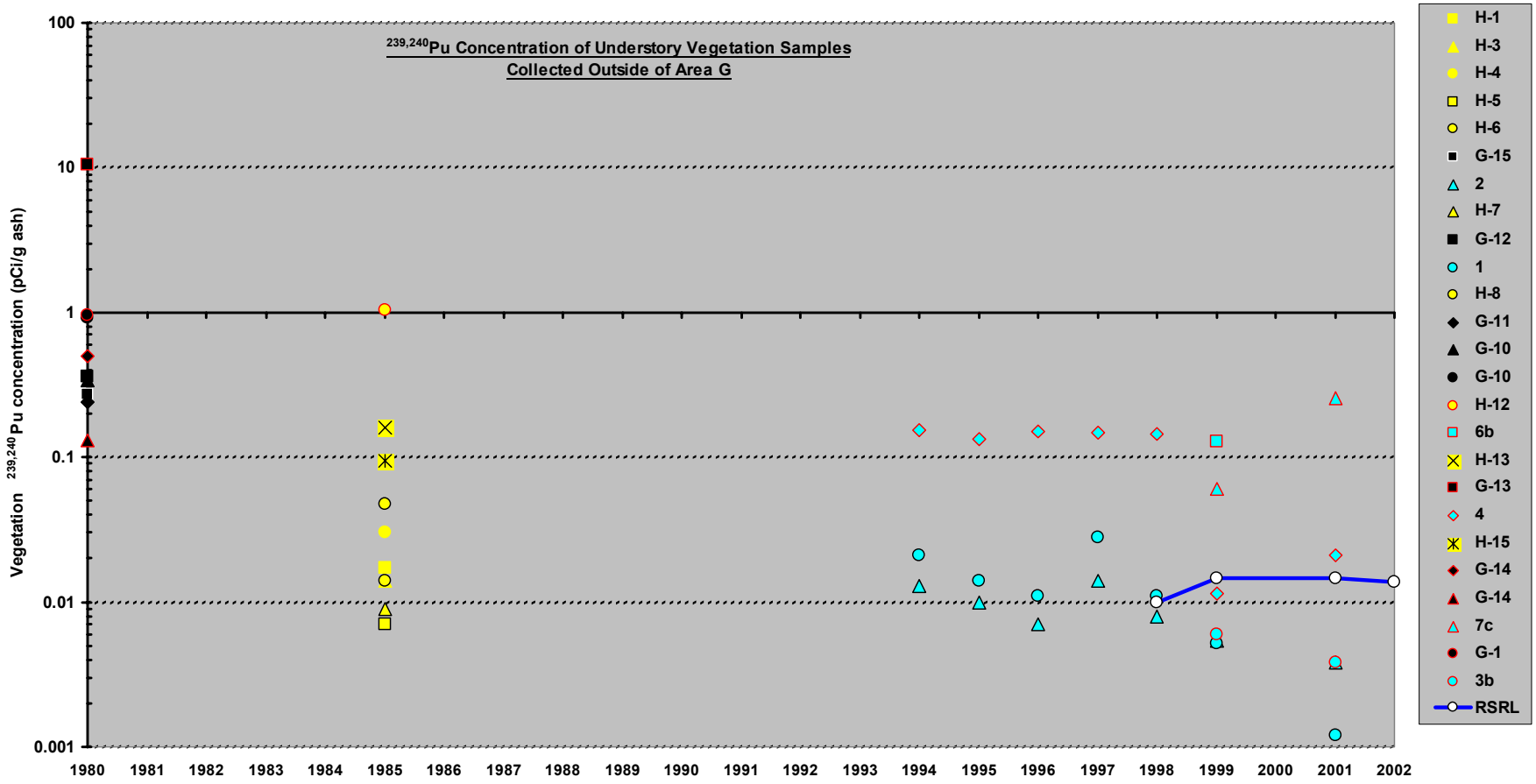

Figure 33. Concentrations of ^{239,240}Pu in understory samples collected outside of Area G from 1980 to 2002 showing a downward trend with time (see Table 7).

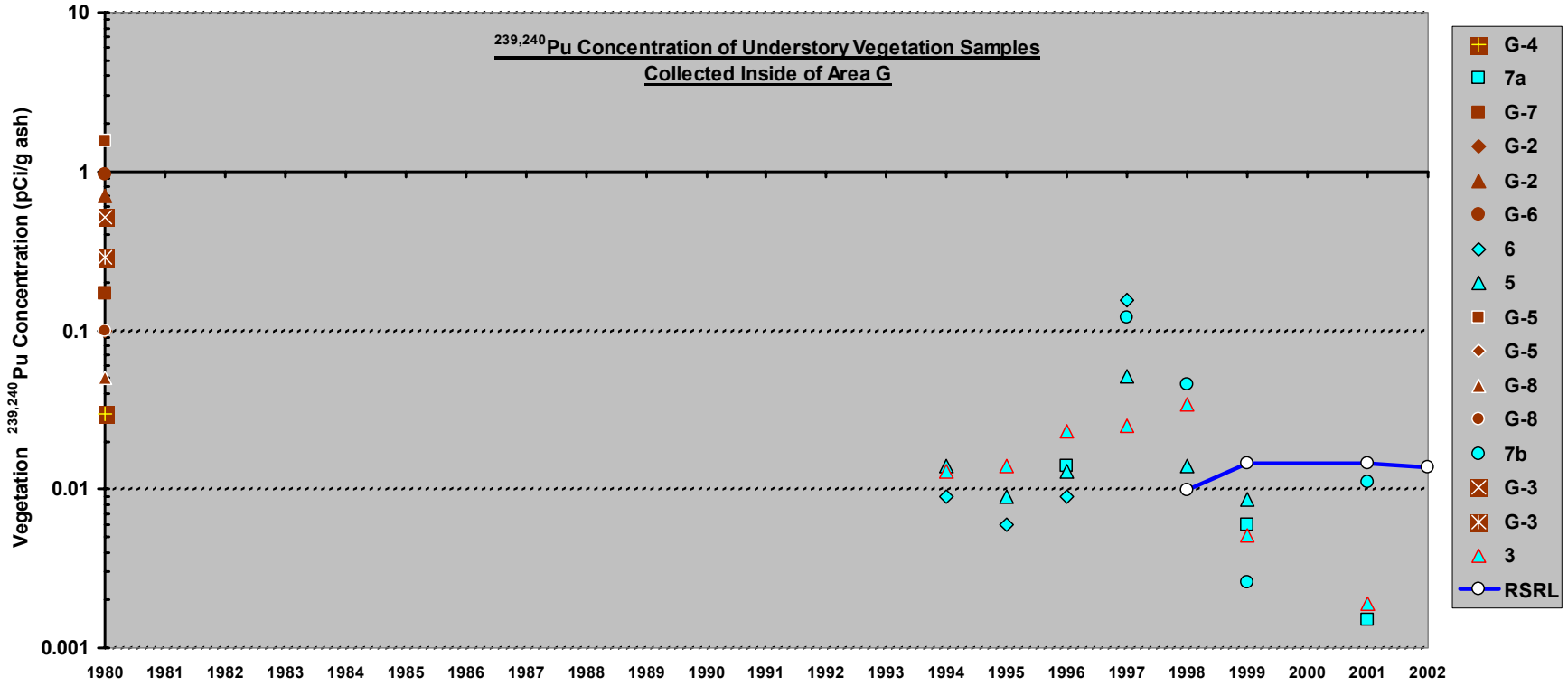

Figure 34. Concentrations of ^{239,240}Pu in understory samples collected inside of Area G from 1980 to 2002 showing a downward trend with time (see Table 7).

samples collected either within Area G or on the Area G perimeter (Table 7).

Unlike the data for the soils, significant trends with time were detected with most of the cases involving plutonium isotopes in vegetation samples (Table 7). Thus, ^{238}Pu and ^{239,240}Pu concentrations were found to decrease with time for overstory vegetation samples collected outside of Area G (Figures 27 and 28), and for understory vegetation samples collected either outside (Figures 31 and 33) or inside (Figures 32 and 34) of Area G. These trend relationships did not seem to be very heavily influenced by the proportion of samples containing equal to or greater than RSRL concentrations of plutonium isotopes (Table 7).

Concentrations of ^{tot}U decreased significantly with time (Table 7) only with overstory vegetation samples collected outside (Figure 29) and inside (Figure 30) of Area G. Just as with the case with plutonium in vegetation samples, these two trend relationships did not seem to be very heavily influenced by the proportion of samples containing equal to or greater than RSRL concentrations of plutonium isotopes (Table 7).

5. CONCLUSIONS

Only 50% and 43% of the soil and vegetation samples, respectively, collected in 2002 contained concentrations of all radionuclides that were equal to or greater than both the TPU (at 99% confidence level) and RSRL values (bold values in Tables 2 and 3). However, the concentrations of almost all radionuclides in the soils were far less than LANL SALs, which were developed to keep potential doses to humans residing on the site to 15 mrem/yr or less (ER, 2001). Soil ^{3}H found in one sample collected on the Area G perimeter adjacent to the ^{3}H shafts did exceed the SAL concentration for soil ^{3}H. Thus, exposure to Area G soils would result in doses greater than the annual 15-mrem limit from any one radionuclide or from all radionuclides combined at this location, unlike all of the other locations where the SAL was not exceeded.

The radionuclide data for 17 soil and 11 plant sampling campaigns collected since 1980 were assembled, compared with radionuclide RSRL and

SAL values, and used to determine statistically whether radionuclide concentrations were increasing or decreasing with time. Statistically significant trends with time were found in 19 out of 45 cases examined. Most radionuclide concentrations in soils and in unwashed overstory and understory vegetation were found to decrease with time. The exception to this general rule involved soil ^{3}H concentrations collected on the southern and southwestern perimeters of Area G which exhibited an upward trend with time.

Based on the results provided in this report (Table 2), exposure to Area G soils would result in doses much less than the annual 15-mrem limit from any one radionuclide or from all radionuclides combined, except for at the one sampling location where the SAL was exceeded. This dose only represents the portion of the total dose that could be received by site workers, for example, via exposure pathways for incidental soil ingestion, dust inhalation, plant ingestion, radon inhalation, and external irradiation. Therefore, exposure to radionuclides in Area G soils poses little risk to either deer and elk (Ferenbaugh et al., 1999) or humans, based on the current data.

ACKNOWLEDGMENTS

Thanks to the 2002 field crew (Rick Velasquez, Louis Naranjo, Jr., and Adrian Martinez) for sample collection and processing. Also, special thanks to Hector Hinojosa for editing and Teresa Hiteman for report preparation.

REFERENCES

ASTM (American Society for Testing and Materials), "Standard Practice for Sampling Surface Soil for Radionuclides," in *Annual Book of ASTM Standards* (American Society for Testing and Materials, Philadelphia, PA (1990).

Bennett, K., J. Biggs, and P.R. Fresquez, "Radionuclide Contaminant Analysis of Small Mammals at Area G, TA-54, 1995," Los Alamos National Laboratory report LA-13242-MS (1996).

Biggs, J.R., K.D. Bennett, and P.R. Fresquez, "Radionuclide Contaminant Analysis of Small Mammals at Area G, TA-54, 1994," Los Alamos National Laboratory report LA-13015-MS (1995).

Biggs, J.R., K.D. Bennett, and P.R. Fresquez, "Radionuclide Contaminant Analysis of Small Mammals at Area G, Technical Area 54, 1996 (with cumulative summary for 1994-1996)," Los Alamos National Laboratory report LA-13345-MS (1997).

Childs, M. and R. Conrad, "Area G Perimeter Surface-Soil and Single-Stage

Water Sampling, Environmental Surveillance for Fiscal Year 95," Los Alamos National Laboratory report LA-13369-PR (1997).

Childs, M. and R. Conrad, "Area G Perimeter Surface-Soil and Single-Stage Water Sampling, Environmental Surveillance for Fiscal Years 1996 and 1997," Los Alamos National Laboratory report LA-13527-PR (1998).

Childs, M. and R. Conrad, "Area G Perimeter Surface-Soil and Single-Stage Water Sampling, Environmental Surveillance for Fiscal Year 1998," Los Alamos National Laboratory report LA-13646-PR (1999).

Conrad, R., M. Childs, C. Rivera-Dirks, and F. Coriz, "Area G Perimeter Surface-Soil and Single-Stage Water Sampling: Environmental Surveillance for Fiscal Year 1993," Los Alamos National Laboratory report LA-12986 (1995).

Conrad, R., M. Childs, C. Rivera-Lyons, and F. Coriz, "Area G Perimeter Surface-Soil and Single-Stage Water Sampling: Environmental Surveillance for Fiscal Year 94," Los Alamos National Laboratory report LA-13165-PR (1996).

Crowe, B.M., G.W. Linn, G. Heiken, and M.L. Bevier, "Stratigraphy of the Bandelier Tuff in the Pajarito Plateau," Los Alamos Scientific Laboratory report LA-7225-MS (1978).

Dames and Moore, "Development of Monitoring Programs for ERDA Owned Radioactive Low-Level Waste Burial Sites," final report (1976).

DOE (US Department of Energy), "Radiation Protection of the Public and the Environment," DOE Order 5400.5 (1990).

DOE-AL (US Department of Energy/Albuquerque Operations Office), "Procedure for the Release of Real Property Containing Residual Radioactive Material," Memorandum from Constance L. Soden, Director, Environment, Safety and Health Division, to D. Glenn, I. Triay, M. Zamorski, E. Sellers, D. Gurule, and D. Bergman-Tabbert, Albuquerque, New Mexico (2000).

EG&G Idaho, "DOE Operating Guidelines for the Shallow Land Burial of Low-Level Radioactive Waste," Interim Draft Number 1 (1978).

EG&G Idaho, "DOE Site Design Criteria for the Shallow Land Burial of Low-Level Radioactive Waste," Draft Number 1 (1981).

EPA (US Environmental Protection Agency), "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination," Memorandum from Stephen D. Luftig, Director, Office of Emergency and Remedial Response, and Larry Weinstock, Acting Director, Office of Radiation and Indoor Air, to addressees, OSWER No. 9200.4-18, Washington, DC (1997).

Environmental Protection Group, Environmental Science Group, and Waste Management Group, "Environmental Surveillance of Low-Level Radioactive Waste Management Areas at Los Alamos During 1987," Los Alamos National Laboratory report LA-UR-90-3283 (1990).

Environmental Restoration (ER), "Derivation and Use of Radionuclide Screening Action Levels," Los Alamos National Laboratory report LA-UR-01-990 (2001).

Environmental Science Group, Environmental Surveillance Group, and Health and Environmental Chemistry Group, "Environmental Surveillance of Low-Level Radioactive Waste Management Areas at Los Alamos during 1985," Los Alamos National Laboratory report LA-UR-87-139 (1987a).

Environmental Science Group, Environmental Surveillance Group, Health and Environmental Chemistry Group, and Waste Management Group, "Environmental Surveillance of Low-Level Radioactive Waste Management Areas at Los Alamos during 1986," Los Alamos National Laboratory report LA-UR-87-4121 (1987b).

Environmental Surveillance Group, "Environmental Surveillance at Los Alamos during 1980," Los Alamos Scientific Laboratory report LA-8810-ENV (1981).

Environmental Surveillance Group, "Environmental Surveillance at Los Alamos during 1982," Los Alamos National Laboratory report LA-9762-ENV (1983).

Ferenbaugh, J.K., P.R. Fresquez, M.H. Ebinger, G.J. Gonzales, and P.A. Jordan, "Elk and Deer Study, Material Disposal Area G, Technical Area 54: Source Document," Los Alamos National Laboratory report LA-13596-MS (1999).

Fresquez, P.R., "Soil, Foodstuffs, and Associated Biota," Chapter 6 in Los Alamos National Laboratory, "Environmental Surveillance at Los Alamos during 1997," Los Alamos National Laboratory report LA-13487-ENV (1998).

Fresquez, P.R. and G. Gonzales, "Soil, Foodstuffs, and Associated Biota," Chapter 6 in Los Alamos National Laboratory, "Environmental Surveillance at Los Alamos during 1999," Los Alamos National Laboratory report LA-13775-ENV (2000).

Fresquez, P.R. and J. Nyhan, "Quality Assurance Project Plan for the Soil, Foodstuffs, and Biota Monitoring Project," Los Alamos National Laboratory Controlled Document ECO-CMT-QAPP, R1 (2003).

Fresquez, P.R., J.R. Biggs, and K.D. Bennett, "Radionuclide Concentrations in Vegetation at Radioactive-Waste Disposal Area G During the 1994 Growing Season," Los Alamos National Laboratory report LA-12954-MS (1995).

Fresquez, P.R., E.L. Vold, and L. Naranjo, Jr., "Radionuclide Concentrations in/on Vegetation at Radioactive-Waste Disposal Area G during the 1995 Growing Season," Los Alamos National Laboratory report LA-13124-PR (1996a).

Fresquez, P.R., M.A. Mullen, J.K. Ferenbaugh, and R.A. Perona, "Radionuclides and Radioactivity in Soils Within and Around Los Alamos National Laboratory, 1974 to 1994: Concentrations, Trends, and Dose Comparisons," Los Alamos National Laboratory report LA-13149-MS (1996b).

Fresquez, P.R., D.R. Armstrong, and L.H. Pratt, "Tritium Concentrations in Bees and Honey at Los Alamos National Laboratory: 1979-1996," Los Alamos National Laboratory report LA-13202-MS (1997a).

Fresquez, P.R., E.L. Vold, and L. Naranjo, Jr., "Radionuclide Concentrations in Soils and Vegetation at Radioactive-Waste Disposal Area G during the 1996 Growing Season," Los Alamos National Laboratory report LA-13332-PR (1997b).

Fresquez, P.R., R.J. Wechsler, and L. Naranjo, Jr., "Radionuclide Concentrations in Soils and Vegetation at Low-Level Radioactive Waste Disposal Area G during the 1997 Growing Season," Los Alamos National Laboratory report LA-13495-PR (1998a).

Fresquez, P.R., D.R. Armstrong, and M.A. Mullen, "Radionuclides and Radioactivity in Soils Collected from Within and Around Los Alamos National Laboratory: 1974-1996," Journal of Environmental Science and Health, A33(2):263–278 (1998b).

Fresquez, P.R., "Soil, Foodstuffs, and Associated Biota," Chapter 6 in Los Alamos National Laboratory, "Environmental Surveillance at Los Alamos during 1998," Los Alamos National Laboratory report LA-13633-ENV (1999a).

Fresquez, P.R., M.H. Ebinger, R.J. Wechsler, and L. Naranjo, Jr., "Radionuclide Concentrations in Soils and Vegetation at Low-Level Radioactive Waste Disposal Area G during the 1998 Growing Season (with a cumulative summary of ^{3}H and $^{239,240}Pu$ over time)," Los Alamos National Laboratory report LA-13647-PR (1999b).

Fresquez, P.R., G. Gonzales, T. Haarmann, J. Nyhan, and B. Gallaher, "Soil, Foodstuffs, and Associated Biota," Chapter 6 in Los Alamos National Laboratory, "Environmental Surveillance at Los Alamos during 2000," Los Alamos National Laboratory report LA-13861-ENV (2001).

Fresquez, P.R., G. Gonzales, J. Nyhan, T. Haarmann, L. Soholt, and B. Gallaher, "Soil, Foodstuffs, and Associated Biota," Chapter 6 in Los Alamos National Laboratory, "Environmental Surveillance at Los Alamos during 2001," Los Alamos National Laboratory report LA-13979-ENV (2002).

Fresquez, P.R., J. Nyhan, B. Gallaher, and G. Gonzales, "Soil Monitoring," Chapter 7 in Los Alamos National Laboratory, "Environmental Surveillance at Los Alamos during 2002," Los Alamos National Laboratory report, in preparation (2003a).

Fresquez, P.R., G. Gonzales, J. Nyhan, L. Soholt, T. Haarmann, and D. Keller, "Foodstuffs and Biota Monitoring," Chapter 8 in Los Alamos National Laboratory, "Environmental Surveillance at Los Alamos during 2002," Los Alamos National Laboratory report, in preparation (2003b).

Gonzales, G.J., R.L. Budd, P.R. Fresquez, and R.J. Wechsler, "Source Document: The Relationship between Pocket Gophers (*Thomomys bottae*) and the Distribution of Buried Radioactive Waste at the Los Alamos National Laboratory," Los Alamos National

Laboratory report LA-13719-MS (2000a).

Gonzales, G.J., P.R. Fresquez, M.A. Mullen, and L. Naranjo, Jr., "Radionuclide Concentrations in Vegetation at the Los Alamos National Laboratory," Los Alamos National Laboratory report LA-13704-PR (2000b).

Haarmann, T.K. and P.R. Fresquez, "Radionuclide Concentrations in Honey Bees from Area G at TA-54 during 1997," Los Alamos National Laboratory report LA-13480-PR (1998).

Haarmann, T.K. and P.R. Fresquez, "Radionuclide Concentrations in Honey Bees from Area G at TA-54 during 1998," Los Alamos National Laboratory report LA-13613-PR (1999).

Hakonson, T.E., R.L. Watters, and W.C. Hanson, "The Transport of Plutonium in Terrestrial Ecosystems," Health Physics, 40:63–69 (1981).

Hansen, W.R., D.L. Mayfield, and L.J. Walker, "Interim Environmental Surveillance Plan for LASL Radioactive Waste Areas," Los Alamos Scientific Laboratory report LA-UR-80-3110 (1980).

Healy, J.W., "An Examination of the Pathways from Soil to Man for Plutonium," Los Alamos Scientific Laboratory report LA-6741-MS (1977).

Jacobson, K., "Soil and Vegetation Sampling at TA-54, Area G," Los Alamos National Laboratory memorandum EM-8:92-3003 to Johnny Harper (1992a).

Jacobson, K., "Environmental Surveillance of Low-level Radioactive Waste Management Areas at Los Alamos during 1989," Unpublished IT Corporation draft report (1992b).

Kendall, M.G., *Rank Correlation Methods*, (4th ed.), London: Griffin (1975).

Los Alamos National Laboratory, "The Spade and Scoop Method of Collection of Soil Samples," Environmental Restoration Program Standard Operating Procedure LANL-ER-SOP-06.09, Los Alamos, NM (1995).

Los Alamos National Laboratory, "Waste Project Finishes Dramatically Under Budget and Far Ahead of Schedule," LANL Daily Newsbulletin, December 20 (2001).

Los Alamos National Laboratory, "Environmental Surveillance at Los Alamos During 2001," Los Alamos National Laboratory report LA-13979-ENV (2002).

Mayfield, D. and W.R. Hansen, "Surface Reconnaissance Through 1980 for Radioactivity at Radioactive Waste Disposal Area G at the Los Alamos National Laboratory," Los Alamos National Laboratory report LA-9656-MS (1983).

McLin, S.G. and D.W. Lyons, "Background Radioactivity in River and Reservoir Sediments near Los Alamos, New Mexico," Los Alamos National Laboratory report LA-13603-MS (2002).

Mullen, K., S. Collins, and D. Rogers, "1993 to 1995 Environmental Surveillance Data Collected at or Near

Area G," Los Alamos National Laboratory report LA-13204-MS (1996).

Nyhan, J.W, P.R. Fresquez, W.R. Velasquez, and E.A. Lopez, "Radionuclide Concentrations in Soils and Vegetation at Low-level Radioactive Waste Disposal Area G during the 1999 Growing Season," Los Alamos National Laboratory report LA-13771-PR (2000).

Nyhan, J.W., P.R. Fresquez, W.R. Velasquez, and E.A. Lopez, "Radionuclide Concentrations in Soils at Low-Level Radioactive Waste Disposal Area G during the 2000 Growing Season," Los Alamos National Laboratory report LA-13864-PR (2001).

Nyhan, J.W., P.R. Fresquez, W.R. Velasquez, and E.A. Lopez, "Radionuclide Concentrations in Soils and Vegetation at Low-Level Radioactive Waste Disposal Area G during the 2001 Growing Season," Los Alamos National Laboratory report LA-13942-PR (2002).

Pearson, E.S., "The Analysis of Variance in Cases of Non-normal Variation," *Biometrika*, **23**: 114–133 (1931).

Purtymun, W.D., M.A. Rogers, and M.L. Wheeler, "Radiochemical Analyses of Samples from Beneath a Solid Radioactive Waste Disposal Pit at Los Alamos, New Mexico," Los Alamos Scientific Laboratory report LA-8422-MS (1980).

Rickard, W.H. and L.J. Kirby, "Trees as Indicators of Subterranean Water Flow from a Retired Radioactive Waste Disposal Site," Health Physics 52(2): 201–206 (1987).

Rogers, D.B., "Impact of Tritium Disposal on Surface Water and Groundwater at Los Alamos National Laboratory thorough 1997," Los Alamos National Laboratory report LA-13465-SR (1998).

Salazar, J.G., "Produce and Fish Sampling Program of Los Alamos National Laboratory's Environmental Surveillance Group," Los Alamos National Laboratory report LA-10186-MS (1984).

Shapiro, S.S. and M.B. Wilk, "An Analysis of Variance Test for Normality (complete samples)," Biometrika, 52, 3 and 4, pages 591–611 (1965).

Soholt, L.F., "Environmental Surveillance of Low-Level Radioactive-Waste-Management Areas at Los Alamos During 1987," Los Alamos National Laboratory report LA-UR-90-3283 (1990).

Tierney, G.D. and T.S. Foxx, "Floristic Composition and Plant Succession on Near-Surface Radioactive Waste Disposal Facilities in the Los Alamos National Laboratory," Los Alamos National Laboratory report LA-9219-MS (1982).

U.S. DOE, "Final Environmental Impact Statement: Los Alamos Scientific Laboratory Site, Los Alamos, New Mexico," U.S. Department of Energy report DOE/EIS-0018 (1979).

Wenzel, W.J., T.S. Foxx, A.F. Gallegos, G. Tierney, and J.C. Rodgers, "Cesium-137, Plutonium-239/240, Total Uranium, and Scandium in Trees and Shrubs Growing in Transuranic Waste at Area B," Los Alamos National Laboratory report LA-11126-MS (1987).

APPENDIX A. CHAIN-OF-CUSTODY FORMS FOR SAMPLES COLLECTED AT AREA G IN 2002

CR04040

CHAIN-OF-CUSTODY RECORD

Charge to PR# 45373
Area G- (C34A)

Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

Soils and Foodstuffs (~~7C20 WE6G~~)
P.I. # (505) 667- 0815
ESH-20 MS M887

Project Name: Area-G Soils

Samplers (signature): [signatures] Lorenzo

Request the following analysis: ^{3}H, Am-241, Cs-137, Pu isotopes, Sr-90, total U, gross alpha, beta gamma

Sample Location/Remarks: AREA G- TA-54, soil samples taken inside the fenced area's and outside the fenced areas

	Date	Time	Sample Name/Number	Number of containers	Sample Location/Remarks
1	3/26/02	1:00	1		South of tritium shafts immediately outside Area-G fence
2	3/26/02	1:15	2		West of the high-level tritium shafts immediately outside Area-G fence
3	3/25/02	10:30	3b		North of Pit 38 outside Area G fence
4	3/25/02	3:00	4		Outside of the Area-G fence North of the TRU WASTE PADS 2 and 4
5	3/25/02	3:45 pm	6b		Southeast of TRU waste Pad 4 outside Area-G fence
6	3/26/02	10:45 AM	7a		Southwestern portions of Pits 17 and 18 (inside the Area G fence)
7	3/26/02	10:15 AM	7b		EAST end of Pit 7 (inside the Area-G fence)
8	5/25/02	1:30	7c		North of Pit 8 outside the Area G fence
9	3/21/02	10:00	8		Proposed expansion area one-half mile west of the entrance gate to Area-G and outside the Area-G fence
10	3/21/02	1:00 p.m.	9		Back ground location near BNP - approx: 5km. South of Area G
11	3/26/02	9:45	3		EAST of Pit 38 (inside the Area G fence)

Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
[signature]	4/11/02 / 12:30 pm	[signature] - Paragon 4-19-02 0925			
Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
Relinquished by: (signature)	Date/Time	Received for Lab by: (signature)	Date/Time	Remarks:	

2982

00104

020402

CHAIN-OF-CUSTODY RECORD

charge to PR# 45373 AREA-G (C34A)

Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

Soils and Foodstuffs (~~720WP16G~~)
P.I. # (505) 667- 0815
ESH-20 MS M887

Project Name		Request the following analysis:	Number of containers	Sample Location/Remarks
Area G Soils		H-3, Am-241, Cs-137, Pu isotopes, Sr-90, total U, gross alpha, beta-gamma		Area G TA-54, soil samples taken inside the fenced area's and outside the fenced areas.
Samplers (signature)				
Date	Time	Sample Name/Number		
12 3/25/02	3:30 pm	G-41-02		East of the eastern end of Pit 2, and TRU Pad 4 (outside the AREA-G fence)
		~~G-42-01~~		
13 3/25/02	2:30 pm	G-43-01		North of TRU Pad 2 (outside the AREA-G fence.)
14 3/25/02	1:30 pm	G-48-02		North of Pit 10 (outside the Area G fence)
15 3/25/02	11:00 am	G-58-01		North of western end of Pit 38 near gate (outside Area G fence.)
16 3/24/02	2:00	La-2403		Southwest of Pit 22 (outside the Area G fence)
17 3/26/02	1:30	G-31-01		Southeast of Disposal Trench C. (outside the Area G fence)

Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
	4/1/02 12:40 pm	4-19-02 0925			
Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
Relinquished by: (signature)	Date/Time	Received for Lab by: (signature)	Date/Time	Remarks:	

CHAIN-OF-CUSTODY RECORD

Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

Soils and Foodstuffs (7H05 WE6G)
P.I. # (505) 667- 0815
RRES-ECO MS M887

0207-044

Project Name: Veg. S, P. (Overstory)
Samplers (signatures): [signature]

Request the following analysis:
Pu Isotopes Cs-137
U Isotopes Sr-90
Am 241

	Date	Time	Sample Name/Number	Number of containers	Sample Location/Remarks
1	6/25/02	2:00	EMBUDO-05		EMBUDO JUNIPER
2	6/25/02	10:30AM	COCHITI-05		COCHITI JUNIPER
3	6/22/02	11:00	JEMEZ-05		JEMEZ JUNIPER
4	6/20/02	2:30	1-05		Otowi PIÑON/JUNIPER
5	6/20/02	2:45	2-05		TA-8 (GT Site) PP/SPRUCE
6	6/20/02	8:30	3-05		Near TA-49(BNP) PP
7	6/19/02	3:32pm	4-05		East Airport PIÑON/JUNIPER
8	[illegible] 6/20/02	7:15pm	5-05		West Airport PP/PIÑON/JUNIPER
9	6/20/02	1:00p.m.	6-05		North Mesa JUNIPER/PP
10	6/20/02	1:20p.m.	7-05		Sportman's Club PP/PIÑON/JUNIPER
11	6/19/02	10:30	8-05		Tsankawi/PM-1 PIÑON/JUNIPER
12	6/19/02	10:10	9-05		White Rock (East) PIÑON/JUNIPER
13	6/26/02	12:30	10-05		San Ildefonso PIÑON/JUNIPER

Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
[signature]	7/08/02 11:30	FedEx	FedEx	7/10/02 0950	[signature]
Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
Relinquished by: (signature)	Date/Time	Received for Lab. by: (signature)	Date/Time	Remarks:	

000255

APPENDIX B. PARAGON ANALYTICS, INC., ANALYTICAL REPORTS OF RADIONUCLIDES IN SOIL AND UNWASHED VEGETATION SAMPLES AT AREA G IN 2002

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Friday, May 10, 2002 09:24:38

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-1	1	TRITIUM	H-3	370 +/- 47	3.9	pCi/mL	Liquid	LS01182	4/30/02	LT
0204090-2	2	TRITIUM	H-3	273 +/- 35	3.8	pCi/mL	Liquid	LS01182	4/30/02	LT
0204090-3	3b	TRITIUM	H-3	6.7 +/- 2.2	3.1	pCi/mL	Liquid	LS01182	4/30/02	LT
0204090-4	4	TRITIUM	H-3	3.3 +/- 2.0	3.2	pCi/mL	Liquid	LS01182	4/30/02	LT
0204090-5	6b	TRITIUM	H-3	2.0 +/- 1.5	2.3	pCi/mL	Liquid	LS01182	4/30/02	U
0204090-6	7a	TRITIUM	H-3	152 +/- 19	2.1	pCi/mL	Liquid	LS01182	4/30/02	LT
0204090-7	7b	TRITIUM	H-3	6.1 +/- 1.6	2.1	pCi/mL	Liquid	LS01182	4/30/02	LT
0204090-8	7c	TRITIUM	H-3	6.9 +/- 2.8	4.2	pCi/mL	Liquid	LS01182	4/30/02	LT
0204090-9	8	TRITIUM	H-3	1.7 +/- 1.8	2.8	pCi/mL	Liquid	LS01182	4/30/02	U
0204090-10	9	TRITIUM	H-3	1.0 +/- 1.1	1.9	pCi/mL	Liquid	LS01182	4/30/02	U
0204090-11	3	TRITIUM	H-3	7.2 +/- 2.1	2.8	pCi/mL	Liquid	LS01182	4/30/02	LT

Comments:

Data Package ID: *H3S0204090-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE8G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Friday, May 10, 2002 09:24:38

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-12	G-41-02	TRITIUM	H-3	4.8 +/- 1.9	2.9	pCi/mL	Liquid	LS01182	4/30/02	LT
0204090-13	G-43-01	TRITIUM	H-3	6.4 +/- 2.3	3.3	pCi/mL	Liquid	LS01182	4/30/02	LT
0204090-14	G-48-02	TRITIUM	H-3	8.3 +/- 2.4	3.3	pCi/mL	Liquid	LS01182	4/30/02	LT
0204090-15	G-58-01	TRITIUM	H-3	6.3 +/- 1.8	2.4	pCi/mL	Liquid	LS01182	4/30/02	LT
0204090-16	G-29-03	TRITIUM	H-3	22000 +/- 2800	15	pCi/mL	Liquid	LS01182	5/1/02	
0204090-17	G-31-01	TRITIUM	H-3	470 +/- 60	4.9	pCi/mL	Liquid	LS01182	5/1/02	LT

Comments:

Data Package ID: *H3S0204090-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Tuesday, May 14, 2002 13:56:58

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-1	1	AM-241	Am-241	0.0088 +/- 0.0049	0.0045	pCi/g	Soil	AS05540	5/9/02	LT
0204090-2	2	AM-241	Am-241	0.0053 +/- 0.0037	0.0040	pCi/g	Soil	AS05540	5/9/02	LT
0204090-3	3b	AM-241	Am-241	0.0104 +/- 0.0051	0.0018	pCi/g	Soil	AS05540	5/8/02	LT
0204090-4	4	AM-241	Am-241	0.212 +/- 0.035	0.0052	pCi/g	Soil	AS05540	5/9/02	
0204090-5	6b	AM-241	Am-241	0.0312 +/- 0.0097	0.0058	pCi/g	Soil	AS05540	5/9/02	
0204090-6	7a	AM-241	Am-241	0.0033 +/- 0.0038	0.0061	pCi/g	Soil	AS05540	5/9/02	U
0204090-7	7b	AM-241	Am-241	0.0075 +/- 0.0055	0.0077	pCi/g	Soil	AS05540	5/9/02	U
0204090-8	7c	AM-241	Am-241	0.052 +/- 0.013	0.0082	pCi/g	Soil	AS05540	5/9/02	
0204090-9	8	AM-241	Am-241	0.0064 +/- 0.0040	0.0041	pCi/g	Soil	AS05540	5/9/02	LT
0204090-10	9	AM-241	Am-241	0.0056 +/- 0.0034	0.0015	pCi/g	Soil	AS05540	5/9/02	LT
0204090-11	3	AM-241	Am-241	0.0212 +/- 0.0079	0.0020	pCi/g	Soil	AS05540	5/9/02	

Comments:

Data Package ID: *AM0204090-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Tuesday, May 14, 2002 13:56:58

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-12	G-41-02	AM-241	Am-241	0.147 +/- 0.027	0.0076	pCi/g	Soil	AS05540	5/9/02	
0204090-13	G-43-01	AM-241	Am-241	0.374 +/- 0.056	0.0049	pCi/g	Soil	AS05540	5/9/02	
0204090-14	G-48-02	AM-241	Am-241	0.163 +/- 0.029	0.0072	pCi/g	Soil	AS05540	5/9/02	
0204090-15	G-58-01	AM-241	Am-241	0.0091 +/- 0.0049	0.0043	pCi/g	Soil	AS05540	5/9/02	LT
0204090-16	G-29-03	AM-241	Am-241	0.0081 +/- 0.0048	0.0056	pCi/g	Soil	AS05540	5/9/02	LT
0204090-17	G-31-01	AM-241	Am-241	0.0071 +/- 0.0050	0.0062	pCi/g	Soil	AS05540	5/10/02	LT

Comments:

Data Package ID: *AM0204090-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: 1
Lab ID: 0204090-1

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 26-Mar-02
Date Analyzed: 06-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020394D01B

Final Aliquot: 94.20 g
Report Basis: Dry Weight
Count Time (min.): 30
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.42 +/- 0.14	0.15	pCi/g	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 half lives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Duplicate Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: 1
Lab ID: 0204090-1-D1

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 26-Mar-02
Date Analyzed: 06-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020452D02A

Final Aliquot: 96.00
Aliquot Units: g
Report Basis: Dry Weight
Count Time (min.): 30

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.49 +/- 0.17	0.15	pCi/g	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
Y2 - Chemical Yield outside default limits.
* - Duplicate DER not within control limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: 2
Lab ID: 0204090-2

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 26-Mar-02
Date Analyzed: 06-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020462D07A

Final Aliquot: 90.90 g
Report Basis: Dry Weight
Count Time (min.): 30
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.32 +/- 0.22	0.31	pCi/g	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: 3b
Lab ID: 0204090-3

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 25-Mar-02
Date Analyzed: 06-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020395D01A

Final Aliquot: 90.80 g
Report Basis: Dry Weight
Count Time (min.): 60
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.35 +/- 0.11	0.12	pCi/g	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: 4
Lab ID: 0204090-4

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 25-Mar-02
Date Analyzed: 06-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020453D02A

Final Aliquot: 79.70 g
Report Basis: Dry Weight
Count Time (min.): 60
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.78 +/- 0.20	0.15	pCi/g	

Comments:

Qualifiers/Flags:
U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: 6b
Lab ID: 0204090-5

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 25-Mar-02
Date Analyzed: 06-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020368D06B

Final Aliquot: 91.50 g
Report Basis: Dry Weight
Count Time (min.): 120
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.151 +/- 0.081	0.12	pCi/g	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: 7b
Lab ID: 0204090-7

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 26-Mar-02
Date Analyzed: 06-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020396D01A

Final Aliquot: 85.40 g
Report Basis: Dry Weight
Count Time (min.): 120
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.028 +/- 0.048	0.080	pCi/g	U

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 6 halflives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: 7c
Lab ID: 0204090-8

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 25-Mar-02
Date Analyzed: 06-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020454D02A

Final Aliquot: 97.70 g
Report Basis: Dry Weight
Count Time (min.): 120
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.022 +/- 0.050	0.084	pCi/g	U

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: 8
Lab ID: 0204090-9

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 21-Mar-02
Date Analyzed: 06-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020455D02A

Final Aliquot: 88.70 g
Report Basis: Dry Weight
Count Time (min.): 120
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.345 +/- 0.093	0.084	pCi/g	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: 9
Lab ID: 0204090-10

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 21-Mar-02
Date Analyzed: 06-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020369D06A

Final Aliquot: 81.50 g
Report Basis: Dry Weight
Count Time (min.): 150
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.317 +/- 0.095	0.10	pCi/g	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: 3
Lab ID: 0204090-11

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 26-Mar-02
Date Analyzed: 07-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020399D01A

Final Aliquot: 94.90 g
Report Basis: Dry Weight
Count Time (min.): 120
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.363 +/- 0.086	0.081	pCi/g	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: G-41-02
Lab ID: 0204090-12

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 25-Mar-02
Date Analyzed: 07-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020457D02A

Final Aliquot: 84.00 g
Report Basis: Dry Weight
Count Time (min.): 120
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.52 +/- 0.12	0.092	pCi/g	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE8G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: G-43-01
Lab ID: 0204090-13

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 25-Mar-02
Date Analyzed: 07-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020371D06A

Final Aliquot: 75.60 g
Report Basis: Dry Weight
Count Time (min.): 120
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.47 +/- 0.14	0.14	pCi/g	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 half-lives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: G-48-02
Lab ID: 0204090-14

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 25-Mar-02
Date Analyzed: 07-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020467D07A

Final Aliquot: 84.10 g
Report Basis: Dry Weight
Count Time (min.): 120
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.56 +/- 0.15	0.13	pCi/g	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: G-58-01
Lab ID: 0204090-15

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 25-Mar-02
Date Analyzed: 07-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020468D07A

Final Aliquot: 82.80 g
Report Basis: Dry Weight
Count Time (min.): 150
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.55 +/- 0.14	0.11	pCi/g	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater then sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Paragon Analytics Inc.

00026

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: G-29-03
Lab ID: 0204090-16

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 26-Mar-02
Date Analyzed: 07-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020372D06A

Final Aliquot: 89.90 g
Report Basis: Dry Weight
Count Time (min.): 150
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.42 +/- 0.11	0.11	pCi/g	

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Gamma Spectroscopy Results

Method PAI SOP 713R6

Sample Results

Reported on: Thursday, May 09, 2002 13:50:33

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Field ID: G-31-01
Lab ID: 0204090-17

Sample Matrix: Soil
Date Prepared: 30-Apr-02
Prep SOP: PAI 739R5
Prep Batch: GS01474

Date Collected: 26-Mar-02
Date Analyzed: 07-May-02
Analytical SOP: PAI 713R6
Spectrum Code: 020458D02A

Final Aliquot: 91.60 g
Report Basis: Dry Weight
Count Time (min.): 150
Library: USGS

Target Nuclide	Result +/- 2 s TPU	MDC	Reporting Units	Lab Qualifier
Cs-137	0.106 +/- 0.054	0.075	pCi/g	

Comments:

Qualifiers/Flags:
U - Result is less than the sample specific MDC or less than the associated TPU.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.
R - Nuclide has exceeded 8 halflives.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: *GSS0204090-1*

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Thursday, May 09, 2002 13:26:26

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-1	1	PU-ISO	Pu-238	0.0023 +/- 0.0035	0.0061	pCi/g	Soil	AS05540	5/4/02	U
0204090-1	1	PU-ISO	Pu-239	0.0265 +/- 0.0077	0.0035	pCi/g	Soil	AS05540	5/4/02	
0204090-2	2	PU-ISO	Pu-238	0.0046 +/- 0.0041	0.0062	pCi/g	Soil	AS05540	5/4/02	U
0204090-2	2	PU-ISO	Pu-239	0.0263 +/- 0.0076	0.0014	pCi/g	Soil	AS05540	5/4/02	
0204090-3	3b	PU-ISO	Pu-238	0.0069 +/- 0.0038	0.0035	pCi/g	Soil	AS05540	5/4/02	LT
0204090-3	3b	PU-ISO	Pu-239	0.0202 +/- 0.0067	0.0044	pCi/g	Soil	AS05540	5/4/02	
0204090-4	4	PU-ISO	Pu-238	0.538 +/- 0.099	0.016	pCi/g	Soil	AS05540	5/6/02	
0204090-4	4	PU-ISO	Pu-239	0.412 +/- 0.081	0.014	pCi/g	Soil	AS05540	5/6/02	
0204090-5	6b	PU-ISO	Pu-238	0.015 +/- 0.010	0.011	pCi/g	Soil	AS05540	5/6/02	LT
0204090-5	6b	PU-ISO	Pu-239	0.120 +/- 0.032	0.011	pCi/g	Soil	AS05540	5/6/02	
0204090-6	7a	PU-ISO	Pu-238	0.016 +/- 0.011	0.013	pCi/g	Soil	AS05540	5/6/02	LT

Comments:

Data Package ID: *PU0204090-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Thursday, May 09, 2002 13:26:27

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-6	7a	PU-ISO	Pu-239	0.0090 +/- 0.0073	0.0045	pCi/g	Soil	AS05540	5/6/02	LT
0204090-7	7b	PU-ISO	Pu-238	0.0061 +/- 0.0040	0.0033	pCi/g	Soil	AS05540	5/5/02	LT
0204090-7	7b	PU-ISO	Pu-239	0.061 +/- 0.012	0.0013	pCi/g	Soil	AS05540	5/5/02	
0204090-8	7c	PU-ISO	Pu-238	0.0351 +/- 0.0098	0.0064	pCi/g	Soil	AS05540	5/5/02	
0204090-8	7c	PU-ISO	Pu-239	0.347 +/- 0.050	0.0015	pCi/g	Soil	AS05540	5/5/02	
0204090-9	8	PU-ISO	Pu-238	0.0023 +/- 0.0030	0.0051	pCi/g	Soil	AS05540	5/5/02	U
0204090-9	8	PU-ISO	Pu-239	0.0266 +/- 0.0076	0.0014	pCi/g	Soil	AS05540	5/5/02	
0204090-10	9	PU-ISO	Pu-238	-0.0009 +/- 0.0024	0.0057	pCi/g	Soil	AS05540	5/5/02	U
0204090-10	9	PU-ISO	Pu-239	0.0107 +/- 0.0044	0.0013	pCi/g	Soil	AS05540	5/5/02	LT
0204090-11	3	PU-ISO	Pu-238	0.0104 +/- 0.0047	0.0042	pCi/g	Soil	AS05540	5/5/02	LT
0204090-11	3	PU-ISO	Pu-239	0.045 +/- 0.010	0.0013	pCi/g	Soil	AS05540	5/5/02	

Comments:

Data Package ID: *PU0204090-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Thursday, May 09, 2002 13:26:26

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-12	G-41-02	PU-ISO	Pu-238	1.92 +/- 0.24	0.0073	pCi/g	Soil	AS05540	5/5/02	
0204090-12	G-41-02	PU-ISO	Pu-239	0.553 +/- 0.075	0.0043	pCi/g	Soil	AS05540	5/5/02	
0204090-13	G-43-01	PU-ISO	Pu-238	0.275 +/- 0.041	0.0053	pCi/g	Soil	AS05540	5/5/02	
0204090-13	G-43-01	PU-ISO	Pu-239	0.611 +/- 0.082	0.0014	pCi/g	Soil	AS05540	5/5/02	
0204090-14	G-48-02	PU-ISO	Pu-238	0.188 +/- 0.031	0.0043	pCi/g	Soil	AS05540	5/5/02	
0204090-14	G-48-02	PU-ISO	Pu-239	0.77 +/- 0.10	0.0054	pCi/g	Soil	AS05540	5/5/02	
0204090-15	G-58-01	PU-ISO	Pu-238	0.0039 +/- 0.0043	0.0069	pCi/g	Soil	AS05540	5/5/02	U
0204090-15	G-58-01	PU-ISO	Pu-239	0.0318 +/- 0.0096	0.0062	pCi/g	Soil	AS05540	5/5/02	
0204090-16	G-29-03	PU-ISO	Pu-238	0.0041 +/- 0.0032	0.0043	pCi/g	Soil	AS05540	5/5/02	U
0204090-16	G-29-03	PU-ISO	Pu-239	0.0261 +/- 0.0076	0.0043	pCi/g	Soil	AS05540	5/5/02	
0204090-17	G-31-01	PU-ISO	Pu-238	0.0069 +/- 0.0044	0.0057	pCi/g	Soil	AS05540	5/5/02	LT

Comments:

Data Package ID: *PU0204090-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Thursday, May 09, 2002 13:26:26

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-17	G-31-01	PU-ISO	Pu-239	0.0289 +/- 0.0080	0.0014	pCi/g	Soil	AS05540	5/5/02	

Comments:

Data Package ID: *PU0204090-1*

Qualifiers/Flags:

U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Friday, May 10, 2002 11:53:22

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-1	1	SR_90	Sr-90	0.12 +/- 0.18	0.31	pCi/g	Soil	SR00164	5/8/02	U
0204090-2	2	SR_90	Sr-90	0.21 +/- 0.16	0.26	pCi/g	Soil	SR00164	5/8/02	U
0204090-3	3b	SR_90	Sr-90	0.05 +/- 0.16	0.27	pCi/g	Soil	SR00164	5/8/02	U
0204090-4	4	SR_90	Sr-90	0.30 +/- 0.18	0.27	pCi/g	Soil	SR00164	5/8/02	LT
0204090-5	6b	SR_90	Sr-90	0.21 +/- 0.16	0.30	pCi/g	Soil	SR00164	5/8/02	U
0204090-6	7a	SR_90	Sr-90	0.03 +/- 0.16	0.28	pCi/g	Soil	SR00164	5/8/02	U
0204090-7	7b	SR_90	Sr-90	-0.04 +/- 0.13	0.23	pCi/g	Soil	SR00164	5/8/02	U
0204090-8	7c	SR_90	Sr-90	0.07 +/- 0.14	0.24	pCi/g	Soil	SR00164	5/8/02	U,Y1
0204090-9	8	SR_90	Sr-90	0.10 +/- 0.14	0.24	pCi/g	Soil	SR00164	5/8/02	U
0204090-10	9	SR_90	Sr-90	0.10 +/- 0.15	0.25	pCi/g	Soil	SR00164	5/8/02	U
0204090-11	3	SR_90	Sr-90	0.15 +/- 0.16	0.26	pCi/g	Soil	SR00164	5/8/02	U

Comments:

Data Package ID: *SRS0204090-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Friday, May 10, 2002 11:53:23

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-12	G-41-02	SR_90	Sr-90	0.20 +/- 0.16	0.25	pCi/g	Soil	SR00164	5/8/02	U
0204090-13	G-43-01	SR_90	Sr-90	0.17 +/- 0.17	0.28	pCi/g	Soil	SR00164	5/8/02	U
0204090-14	G-48-02	SR_90	Sr-90	0.12 +/- 0.15	0.25	pCi/g	Soil	SR00164	5/8/02	U
0204090-15	G-58-01	SR_90	Sr-90	0.19 +/- 0.16	0.26	pCi/g	Soil	SR00164	5/8/02	U
0204090-16	G-29-03	SR_90	Sr-90	0.12 +/- 0.15	0.25	pCi/g	Soil	SR00164	5/8/02	U
0204090-17	G-31-01	SR_90	Sr-90	0.06 +/- 0.14	0.25	pCi/g	Soil	SR00164	5/8/02	U

Comments:

Data Package ID: *SRS0204090-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Thursday, May 09, 2002 14:25:45

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-1	1	U-ISO	U-234	9.4E-01 +/- 1.8E-01	2.3E-02	pCi/g	Soil	AS05540	5/3/02	
0204090-1	1	U-ISO	U-235	6.1E-02 +/- 2.8E-02	1.6E-02	pCi/g	Soil	AS05540	5/3/02	LT
0204090-1	1	U-ISO	U-238	1.1E+00 +/- 1.9E-01	2.1E-02	pCi/g	Soil	AS05540	5/3/02	
0204090-2	2	U-ISO	U-234	9.1E-01 +/- 1.7E-01	2.3E-02	pCi/g	Soil	AS05540	5/3/02	
0204090-2	2	U-ISO	U-235	6.5E-02 +/- 3.0E-02	2.9E-02	pCi/g	Soil	AS05540	5/3/02	LT
0204090-2	2	U-ISO	U-238	9.7E-01 +/- 1.8E-01	2.6E-02	pCi/g	Soil	AS05540	5/3/02	
0204090-3	3b	U-ISO	U-234	8.3E-01 +/- 1.6E-01	1.5E-02	pCi/g	Soil	AS05540	5/3/02	
0204090-3	3b	U-ISO	U-235	5.1E-02 +/- 2.4E-02	1.7E-02	pCi/g	Soil	AS05540	5/3/02	LT
0204090-3	3b	U-ISO	U-238	8.2E-01 +/- 1.5E-01	7.9E-03	pCi/g	Soil	AS05540	5/3/02	
0204090-4	4	U-ISO	U-234	1.1E+00 +/- 1.9E-01	1.8E-02	pCi/g	Soil	AS05540	5/3/02	
0204090-4	4	U-ISO	U-235	9.6E-02 +/- 3.4E-02	1.8E-02	pCi/g	Soil	AS05540	5/3/02	LT

Comments:

Data Package ID: *U0204090-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 742)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Thursday, May 09, 2002 14:25:46

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-4	4	U-ISO	U-238	1.2E+00 +/- 2.0E-01	2.1E-02	pCi/g	Soil	AS05540	5/3/02	
0204090-5	6b	U-ISO	U-234	8.1E-01 +/- 1.5E-01	2.2E-02	pCi/g	Soil	AS05540	5/3/02	
0204090-5	6b	U-ISO	U-235	3.7E-02 +/- 2.1E-02	1.8E-02	pCi/g	Soil	AS05540	5/3/02	LT
0204090-5	6b	U-ISO	U-238	7.5E-01 +/- 1.4E-01	1.5E-02	pCi/g	Soil	AS05540	5/3/02	
0204090-6	7a	U-ISO	U-234	1.1E+00 +/- 1.8E-01	1.3E-02	pCi/g	Soil	AS05540	5/3/02	
0204090-6	7a	U-ISO	U-235	7.5E-02 +/- 2.9E-02	2.0E-02	pCi/g	Soil	AS05540	5/3/02	LT
0204090-6	7a	U-ISO	U-238	1.1E+00 +/- 1.8E-01	2.1E-02	pCi/g	Soil	AS05540	5/3/02	
0204090-7	7b	U-ISO	U-234	1.0E+00 +/- 1.9E-01	1.9E-02	pCi/g	Soil	AS05540	5/3/02	
0204090-7	7b	U-ISO	U-235	1.0E-01 +/- 3.8E-02	1.6E-02	pCi/g	Soil	AS05540	5/3/02	
0204090-7	7b	U-ISO	U-238	1.1E+00 +/- 2.0E-01	8.8E-03	pCi/g	Soil	AS05540	5/3/02	
0204090-8	7c	U-ISO	U-234	9.2E-01 +/- 1.5E-01	2.5E-02	pCi/g	Soil	AS05540	5/7/02	

Comments:

Data Package ID: *U0204090-1*

Qualifiers/flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Thursday, May 09, 2002 14:25:47

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-8	7c	U-ISO	U-235	6.4E-02 +/- 2.7E-02	2.0E-02	pCi/g	Soil	AS05540	5/7/02	LT
0204090-8	7c	U-ISO	U-238	8.4E-01 +/- 1.5E-01	2.3E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-9	8	U-ISO	U-234	9.9E-01 +/- 1.9E-01	1.9E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-9	8	U-ISO	U-235	5.0E-02 +/- 2.5E-02	1.9E-02	pCi/g	Soil	AS05540	5/7/02	LT
0204090-9	8	U-ISO	U-238	1.0E+00 +/- 1.9E-01	1.6E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-10	9	U-ISO	U-234	8.9E-01 +/- 1.6E-01	1.6E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-10	9	U-ISO	U-235	8.0E-02 +/- 2.8E-02	1.4E-02	pCi/g	Soil	AS05540	5/7/02	LT
0204090-10	9	U-ISO	U-238	9.7E-01 +/- 1.7E-01	1.9E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-11	3	U-ISO	U-234	9.6E-01 +/- 1.6E-01	2.4E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-11	3	U-ISO	U-235	7.2E-02 +/- 3.0E-02	2.3E-02	pCi/g	Soil	AS05540	5/7/02	LT
0204090-11	3	U-ISO	U-238	9.0E-01 +/- 1.7E-01	1.5E-02	pCi/g	Soil	AS05540	5/7/02	

Comments:

Data Package ID: *U0204090-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Thursday, May 09, 2002 14:25:46

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-12	G-41-02	U-ISO	U-234	1.1E+00 +/- 1.9E-01	1.6E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-12	G-41-02	U-ISO	U-235	6.6E-02 +/- 2.6E-02	1.6E-02	pCi/g	Soil	AS05540	5/7/02	LT
0204090-12	G-41-02	U-ISO	U-238	1.2E+00 +/- 2.1E-01	6.6E-03	pCi/g	Soil	AS05540	5/7/02	
0204090-13	G-43-01	U-ISO	U-234	1.0E+00 +/- 1.8E-01	1.9E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-13	G-43-01	U-ISO	U-235	9.2E-02 +/- 3.2E-02	1.9E-02	pCi/g	Soil	AS05540	5/7/02	LT
0204090-13	G-43-01	U-ISO	U-238	1.0E+00 +/- 1.8E-01	1.5E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-14	G-48-02	U-ISO	U-234	1.1E+00 +/- 1.9E-01	1.7E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-14	G-48-02	U-ISO	U-235	8.4E-02 +/- 3.2E-02	2.1E-02	pCi/g	Soil	AS05540	5/7/02	LT
0204090-14	G-48-02	U-ISO	U-238	1.0E+00 +/- 1.8E-01	2.3E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-15	G-58-01	U-ISO	U-234	9.3E-01 +/- 1.6E-01	2.0E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-15	G-58-01	U-ISO	U-235	6.3E-02 +/- 2.6E-02	2.2E-02	pCi/g	Soil	AS05540	5/7/02	LT

Comments:

Data Package ID: *U0204090-1*

Qualifiers/Flags:

U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 769)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area G Soils
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0204090

Reported on: Thursday, May 09, 2002 14:25:46

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0204090-15	G-56-01	U-ISO	U-238	1.0E+00 +/- 1.8E-01	2.0E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-16	G-29-03	U-ISO	U-234	8.8E-01 +/- 1.5E-01	1.6E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-16	G-29-03	U-ISO	U-235	7.9E-02 +/- 2.7E-02	1.6E-02	pCi/g	Soil	AS05540	5/7/02	LT
0204090-16	G-29-03	U-ISO	U-238	9.8E-01 +/- 1.6E-01	1.1E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-17	G-31-01	U-ISO	U-234	8.7E-01 +/- 1.6E-01	2.4E-02	pCi/g	Soil	AS05540	5/7/02	
0204090-17	G-31-01	U-ISO	U-235	5.9E-02 +/- 2.6E-02	1.8E-02	pCi/g	Soil	AS05540	5/7/02	LT
0204090-17	G-31-01	U-ISO	U-238	8.6E-01 +/- 1.6E-01	1.8E-02	pCi/g	Soil	AS05540	5/7/02	

Comments:

Data Package ID: *U0204090-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Vegetation S.P. (Overstory)
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0207184

Reported on: Thursday, August 08, 2002 12:43:49

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0207184-1	1-OS	TRITIUM	H-3	762 +/- 97	2.1	pCi/mL	Water	LS01326	8/7/02	
0207184-2	2-OS	TRITIUM	H-3	122 +/- 16	0.79	pCi/mL	Water	LS01326	8/7/02	LT
0207184-3	3-OS	TRITIUM	H-3	8.8 +/- 1.2	0.49	pCi/mL	Water	LS01326	8/7/02	LT
0207184-4	3b-OS	TRITIUM	H-3	3.04 +/- 0.54	0.50	pCi/mL	Water	LS01326	8/7/02	LT
0207184-5	4-OS	TRITIUM	H-3	12.6 +/- 1.7	0.50	pCi/mL	Water	LS01326	8/7/02	LT
0207184-6	6b-OS	TRITIUM	H-3	2.19 +/- 0.45	0.50	pCi/mL	Water	LS01326	8/7/02	LT
0207184-7	7c-OS	TRITIUM	H-3	8.6 +/- 1.2	0.50	pCi/mL	Water	LS01326	8/7/02	LT
0207184-8	8-OS	TRITIUM	H-3	8.5 +/- 1.2	0.50	pCi/mL	Water	LS01326	8/7/02	LT
0207184-9	9-OS	TRITIUM	H-3	8.0 +/- 1.1	0.50	pCi/mL	Water	LS01326	8/7/02	LT
0207184-10	G-41-02-OS	TRITIUM	H-3	12.0 +/- 1.6	0.50	pCi/mL	Water	LS01326	8/7/02	LT

Comments:

Data Package ID: *H3L0207184-1*

Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Vegetation S.P. (Overstory)
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0207044

Reported on: Tuesday, August 20, 2002 11:35:47

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0207044-1	EMBUDO-OS	AM-241	Am-241	0.0045 +/- 0.0034	0.0019	pCi/g	Ash	AS05715	8/14/02	LT
0207044-2	COCHITI-OS	AM-241	Am-241	0.0023 +/- 0.0038	0.0063	pCi/g	Ash	AS05715	8/14/02	U
0207044-3	JEMEZ-OS	AM-241	Am-241	0.0007 +/- 0.0026	0.0020	pCi/g	Ash	AS05715	8/14/02	U
0207044-4	1-OS	AM-241	Am-241	0.0027 +/- 0.0026	0.0016	pCi/g	Ash	AS05715	8/17/02	LT
0207044-5	2-OS	AM-241	Am-241	0.0016 +/- 0.0035	0.0072	pCi/g	Ash	AS05715	8/14/02	U
0207044-6	3-OS	AM-241	Am-241	0.0012 +/- 0.0076	0.016	pCi/g	Ash	AS05715	8/14/02	U
0207044-7	4-OS	AM-241	Am-241	0.0014 +/- 0.0040	0.0090	pCi/g	Ash	AS05715	8/14/02	U
0207044-8	5-OS	AM-241	Am-241	0.0008 +/- 0.0039	0.0091	pCi/g	Ash	AS05715	8/19/02	U
0207044-9	6-OS	AM-241	Am-241	0.0068 +/- 0.0058	0.0081	pCi/g	Ash	AS05715	8/15/02	U
0207044-10	7-OS	AM-241	Am-241	0.0103 +/- 0.0079	0.010	pCi/g	Ash	AS05715	8/14/02	U
0207044-11	8-OS	AM-241	Am-241	0.0028 +/- 0.0042	0.0079	pCi/g	Ash	AS05715	8/14/02	U

Comments:

Data Package ID: *AM0207044-1*

Qualifiers/Flags:

U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Vegetation S.P. (Overstory)
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0207044

Reported on: Tuesday, August 20, 2002 11:35:47

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0207044-12	9-OS	AM-241	Am-241	0.0093 +/- 0.0064	0.0089	pCi/g	Ash	AS05715	8/14/02	LT
0207044-13	10-OS	AM-241	Am-241	0.0154 +/- 0.0073	0.0024	pCi/g	Ash	AS05715	8/14/02	LT

Comments:

Data Package ID: *AM0207044-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Area-G Overstory Vegetation
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0207183

Reported on: Tuesday, August 20, 2002 17:14:59

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0207183-3	3-OS	GammaScan	Cs-137	-0.18 +/- 0.36	0.63	pCi/g	Ash	GS01628	8/1/02	U
0207183-4	3b-OS	GammaScan	Cs-137	-0.05 +/- 0.34	0.58	pCi/g	Ash	GS01628	8/1/02	U
0207183-6	6b-OS	GammaScan	Cs-137	0.14 +/- 0.50	0.84	pCi/g	Ash	GS01628	8/1/02	U
0207183-7	7c-OS	GammaScan	Cs-137	-0.13 +/- 0.36	0.63	pCi/g	Ash	GS01628	8/1/02	U
0207183-10	G-41-02-OS	GammaScan	Cs-137	-0.29 +/- 0.51	0.91	pCi/g	Ash	GS01628	8/2/02	U

Comments:

Data Package ID: *GSW0207183-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC or less than the associated TPU.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Vegetation S.P. (Overstory)
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0207044

Reported on: Friday, September 06, 2002 09:32:09

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0207044-1	EMBUDO-OS	GammaScan	Cs-137	0.32 +/- 0.32	0.51	pCi/g	Ash	GS01678	9/4/02	U
0207044-2	COCHITI-OS	GammaScan	Cs-137	-0.28 +/- 0.32	0.56	pCi/g	Ash	GS01678	9/4/02	U
0207044-3	JEMEZ-OS	GammaScan	Cs-137	0.11 +/- 0.49	0.82	pCi/g	Ash	GS01678	9/4/02	U
0207044-4	1-OS	GammaScan	Cs-137	-0.27 +/- 0.49	0.85	pCi/g	Ash	GS01678	9/4/02	U
0207044-5	2-OS	GammaScan	Cs-137	0.07 +/- 0.38	0.63	pCi/g	Ash	GS01678	9/4/02	U
0207044-7	4-OS	GammaScan	Cs-137	0.23 +/- 0.38	0.63	pCi/g	Ash	GS01678	9/4/02	U
0207044-9	6-OS	GammaScan	Cs-137	-0.43 +/- 0.37	0.64	pCi/g	Ash	GS01678	9/5/02	U
0207044-10	7-OS	GammaScan	Cs-137	0.28 +/- 0.42	0.70	pCi/g	Ash	GS01678	9/4/02	U
0207044-11	8-OS	GammaScan	Cs-137	-0.12 +/- 0.47	0.81	pCi/g	Ash	GS01678	9/5/02	U
0207044-12	9-OS	GammaScan	Cs-137	-0.13 +/- 0.52	0.89	pCi/g	Ash	GS01678	9/5/02	U
0207044-13	10-OS	GammaScan	Cs-137	-0.30 +/- 0.31	0.53	pCi/g	Ash	GS01678	9/5/02	U

Comments:

Data Package ID: *GSS0207044-2*

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

SQ - Spectral quality prevents accurate quantitation.
SI - Nuclide identification and/or quantitation is tentative.
TI - Nuclide identification is tentative.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Vegetation S.P. (Overstory)
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0207044

Reported on: Wednesday, August 14, 2002 16:06:49

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0207044-1	EMBUDO-OS	PU-ISO	Pu-238	-0.0048 +/- 0.0036	0.012	pCi/g	Ash	AS05715	8/11/02	U
0207044-1	EMBUDO-OS	PU-ISO	Pu-239	0.0123 +/- 0.0072	0.0072	pCi/g	Ash	AS05715	8/11/02	LT
0207044-2	COCHITI-OS	PU-ISO	Pu-238	0.0018 +/- 0.0029	0.0049	pCi/g	Ash	AS05715	8/11/02	U
0207044-2	COCHITI-OS	PU-ISO	Pu-239	0.0062 +/- 0.0045	0.0049	pCi/g	Ash	AS05715	8/11/02	LT
0207044-3	JEMEZ-OS	PU-ISO	Pu-238	0.0009 +/- 0.0031	0.0073	pCi/g	Ash	AS05715	8/11/02	U
0207044-3	JEMEZ-OS	PU-ISO	Pu-239	0.0016 +/- 0.0031	0.0024	pCi/g	Ash	AS05715	8/11/02	U
0207044-4	1-OS	PU-ISO	Pu-238	0.0035 +/- 0.0036	0.0052	pCi/g	Ash	AS05715	8/11/02	U
0207044-4	1-OS	PU-ISO	Pu-239	0.0033 +/- 0.0041	0.0073	pCi/g	Ash	AS05715	8/11/02	U
0207044-5	2-OS	PU-ISO	Pu-238	-0.0011 +/- 0.0035	0.0071	pCi/g	Ash	AS05715	8/11/02	U
0207044-5	2-OS	PU-ISO	Pu-239	0.0000 +/- 0.0035	0.0026	pCi/g	Ash	AS05715	8/11/02	U
0207044-6	3-OS	PU-ISO	Pu-238	-0.0007 +/- 0.0033	0.0066	pCi/g	Ash	AS05715	8/11/02	U

Comments:

Data Package ID: *P0207044-1*

Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Vegetation S.P. (Overstory)
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0207044

Reported on: Wednesday, August 14, 2002 16:06:50

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0207044-6	3-OS	PU-ISO	Pu-239	0.0083 +/- 0.0059	0.0077	pCi/g	Ash	AS05715	8/11/02	LT
0207044-7	4-OS	PU-ISO	Pu-238	0.0013 +/- 0.0029	0.0059	pCi/g	Ash	AS05715	8/11/02	U
0207044-7	4-OS	PU-ISO	Pu-239	0.0101 +/- 0.0059	0.0059	pCi/g	Ash	AS05715	8/11/02	LT
0207044-8	5-OS	PU-ISO	Pu-238	0.0028 +/- 0.0049	0.0097	pCi/g	Ash	AS05715	8/12/02	U
0207044-8	5-OS	PU-ISO	Pu-239	0.029 +/- 0.011	0.0067	pCi/g	Ash	AS05715	8/12/02	
0207044-9	6-OS	PU-ISO	Pu-238	-0.0015 +/- 0.0030	0.0085	pCi/g	Ash	AS05715	8/12/02	U
0207044-9	6-OS	PU-ISO	Pu-239	0.0054 +/- 0.0040	0.0023	pCi/g	Ash	AS05715	8/12/02	LT
0207044-10	7-OS	PU-ISO	Pu-238	-0.0009 +/- 0.0050	0.013	pCi/g	Ash	AS05715	8/12/02	U
0207044-10	7-OS	PU-ISO	Pu-239	0.0090 +/- 0.0059	0.0057	pCi/g	Ash	AS05715	8/12/02	LT
0207044-11	8-OS	PU-ISO	Pu-238	0.0015 +/- 0.0034	0.0069	pCi/g	Ash	AS05715	8/12/02	U
0207044-11	8-OS	PU-ISO	Pu-239	0.0087 +/- 0.0061	0.0078	pCi/g	Ash	AS05715	8/12/02	LT

Comments:

Data Package ID: *P0207044-1*

Qualifiers/Flags:

U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Vegetation S.P. (Overstory)
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0207044

Reported on: Wednesday, August 14, 2002 16:06:49

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0207044-12	9-OS	PU-ISO	Pu-238	0.0037 +/- 0.0054	0.010	pCi/g	Ash	AS05715	8/13/02	U
0207044-12	9-OS	PU-ISO	Pu-239	0.031 +/- 0.011	0.0061	pCi/g	Ash	AS05715	8/13/02	
0207044-13	10-OS	PU-ISO	Pu-238	-0.0015 +/- 0.0055	0.014	pCi/g	Ash	AS05715	8/12/02	U
0207044-13	10-OS	PU-ISO	Pu-239	0.027 +/- 0.012	0.0085	pCi/g	Ash	AS05715	8/12/02	

Comments:

Data Package ID: *P0207044-1*

Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Vegetation S.P. (Overstory)
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0207044

Reported on: Thursday, August 08, 2002 14:17:12

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0207044-1	EMBUDO-OS	SR_90	Sr-90	1.54 +/- 0.29	0.090	pCi/g	Ash	SR00214	8/8/02	
0207044-2	COCHITI-OS	SR_90	Sr-90	2.16 +/- 0.40	0.096	pCi/g	Ash	SR00214	8/8/02	
0207044-3	JEMEZ-OS	SR_90	Sr-90	3.03 +/- 0.56	0.11	pCi/g	Ash	SR00214	8/8/02	
0207044-4	1-OS	SR_90	Sr-90	5.37 +/- 0.97	0.067	pCi/g	Ash	SR00214	8/8/02	
0207044-5	2-OS	SR_90	Sr-90	9.7 +/- 1.7	0.066	pCi/g	Ash	SR00214	8/8/02	
0207044-6	3-OS	SR_90	Sr-90	0.94 +/- 0.18	0.057	pCi/g	Ash	SR00214	8/8/02	
0207044-7	4-OS	SR_90	Sr-90	7.6 +/- 1.4	0.064	pCi/g	Ash	SR00214	8/8/02	
0207044-8	5-OS	SR_90	Sr-90	4.06 +/- 0.74	0.057	pCi/g	Ash	SR00214	8/8/02	
0207044-9	6-OS	SR_90	Sr-90	4.77 +/- 0.87	0.068	pCi/g	Ash	SR00214	8/8/02	
0207044-10	7-OS	SR_90	Sr-90	6.8 +/- 1.2	0.058	pCi/g	Ash	SR00214	8/8/02	
0207044-11	8-OS	SR_90	Sr-90	3.41 +/- 0.62	0.063	pCi/g	Ash	SR00214	8/8/02	

Comments:

Data Package ID: *SRA0207044-1*

Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

N Chemical Yield outside default limits.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Vegetation S.P. (Overstory)
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0207044

Reported on: Thursday, August 08, 2002 14:17:12

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0207044-12	9-OS	SR_90	Sr-90	1.30 +/- 0.24	0.066	pCi/g	Ash	SR00214	8/8/02	
0207044-13	10-OS	SR_90	Sr-90	6.7 +/- 1.2	0.070	pCi/g	Ash	SR00214	8/8/02	

Comments:

Data Package ID: *SRA0207044-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Vegetation S.P. (Overstory)
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0207044

Reported on: Thursday, August 15, 2002 11:23:54

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0207044-1	EMBUDO-OS	U-ISO	U-234	0.196 +/- 0.035	0.0092	pCi/g	Ash	AS05715	8/10/02	
0207044-1	EMBUDO-OS	U-ISO	U-235	0.0132 +/- 0.0065	0.0066	pCi/g	Ash	AS05715	8/10/02	
0207044-1	EMBUDO-OS	U-ISO	U-238	0.202 +/- 0.035	0.0074	pCi/g	Ash	AS05715	8/10/02	
0207044-2	COCHITI-OS	U-ISO	U-234	0.092 +/- 0.020	0.0067	pCi/g	Ash	AS05715	8/10/02	
0207044-2	COCHITI-OS	U-ISO	U-235	0.0157 +/- 0.0068	0.0058	pCi/g	Ash	AS05715	8/10/02	
0207044-2	COCHITI-OS	U-ISO	U-238	0.090 +/- 0.019	0.0074	pCi/g	Ash	AS05715	8/10/02	
0207044-3	JEMEZ-OS	U-ISO	U-234	0.105 +/- 0.021	0.0074	pCi/g	Ash	AS05715	8/10/02	
0207044-3	JEMEZ-OS	U-ISO	U-235	0.0083 +/- 0.0058	0.0080	pCi/g	Ash	AS05715	8/10/02	LT
0207044-3	JEMEZ-OS	U-ISO	U-238	0.101 +/- 0.020	0.0053	pCi/g	Ash	AS05715	8/10/02	
0207044-4	1-OS	U-ISO	U-234	0.102 +/- 0.020	0.0076	pCi/g	Ash	AS05715	8/10/02	
0207044-4	1-OS	U-ISO	U-235	0.0121 +/- 0.0065	0.0080	pCi/g	Ash	AS05715	8/10/02	

Comments:

Data Package ID: *U0207044-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Vegetation S.P. (Overstory)
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0207044

Reported on: Thursday, August 15, 2002 11:23:55

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0207044-4	1-OS	U-ISO	U-238	0.077 +/- 0.017	0.0080	pCi/g	Ash	AS05715	8/10/02	
0207044-5	2-OS	U-ISO	U-234	0.076 +/- 0.017	0.0074	pCi/g	Ash	AS05715	8/10/02	
0207044-5	2-OS	U-ISO	U-235	0.0111 +/- 0.0053	0.0042	pCi/g	Ash	AS05715	8/10/02	
0207044-5	2-OS	U-ISO	U-238	0.077 +/- 0.017	0.0042	pCi/g	Ash	AS05715	8/10/02	
0207044-6	3-OS	U-ISO	U-234	0.257 +/- 0.045	0.0084	pCi/g	Ash	AS05715	8/10/02	
0207044-6	3-OS	U-ISO	U-235	0.036 +/- 0.012	0.010	pCi/g	Ash	AS05715	8/10/02	
0207044-6	3-OS	U-ISO	U-238	0.266 +/- 0.046	0.0058	pCi/g	Ash	AS05715	8/10/02	
0207044-7	4-OS	U-ISO	U-234	0.137 +/- 0.026	0.0096	pCi/g	Ash	AS05715	8/10/02	
0207044-7	4-OS	U-ISO	U-235	0.0141 +/- 0.0066	0.0069	pCi/g	Ash	AS05715	8/10/02	
0207044-7	4-OS	U-ISO	U-238	0.206 +/- 0.036	0.0069	pCi/g	Ash	AS05715	8/10/02	
0207044-8	5-OS	U-ISO	U-234	0.123 +/- 0.024	0.0085	pCi/g	Ash	AS05715	8/10/02	

Comments:

Data Package ID: *U0207044-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Vegetation S.P. (Overstory)
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0207044

Reported on: Thursday, August 15, 2002 11:23:55

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0207044-8	5-OS	U-ISO	U-235	0.0156 +/- 0.0065	0.0053	pCi/g	Ash	AS05715	8/10/02	
0207044-8	5-OS	U-ISO	U-238	0.209 +/- 0.036	0.0053	pCi/g	Ash	AS05715	8/10/02	
0207044-9	6-OS	U-ISO	U-234	0.113 +/- 0.022	0.0077	pCi/g	Ash	AS05715	8/10/02	
0207044-9	6-OS	U-ISO	U-235	0.0112 +/- 0.0052	0.0041	pCi/g	Ash	AS05715	8/10/02	
0207044-9	6-OS	U-ISO	U-238	0.141 +/- 0.026	0.0041	pCi/g	Ash	AS05715	8/10/02	
0207044-10	7-OS	U-ISO	U-234	0.164 +/- 0.031	0.011	pCi/g	Ash	AS05715	8/10/02	
0207044-10	7-OS	U-ISO	U-235	0.0141 +/- 0.0072	0.0082	pCi/g	Ash	AS05715	8/10/02	
0207044-10	7-OS	U-ISO	U-238	0.218 +/- 0.038	0.0082	pCi/g	Ash	AS05715	8/10/02	
0207044-11	8-OS	U-ISO	U-234	0.124 +/- 0.023	0.0058	pCi/g	Ash	AS05715	8/10/02	
0207044-11	8-OS	U-ISO	U-235	0.0178 +/- 0.0066	0.0040	pCi/g	Ash	AS05715	8/10/02	
0207044-11	8-OS	U-ISO	U-238	0.165 +/- 0.029	0.0016	pCi/g	Ash	AS05715	8/10/02	

Comments:

Data Package ID: *U0207044-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

Sample Results Summary

Client Name: ESH20_LANL
Client Project Name: Vegetation S.P. (Overstory)
Client Project Number: 7H05 WE6G 3000 0000

Laboratory Name: Paragon Analytics, Inc.
PAI Work Order: 0207044

Reported on: Thursday, August 15, 2002 11:23:54

Lab Sample ID	Client Sample ID	Test	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0207044-12	9-OS	U-ISO	U-234	0.119 +/- 0.024	0.0082	pCi/g	Ash	AS05715	8/10/02	
0207044-12	9-OS	U-ISO	U-235	0.0098 +/- 0.0067	0.0094	pCi/g	Ash	AS05715	8/10/02	LT
0207044-12	9-OS	U-ISO	U-238	0.131 +/- 0.026	0.0068	pCi/g	Ash	AS05715	8/10/02	
0207044-13	10-OS	U-ISO	U-234	0.121 +/- 0.023	0.0072	pCi/g	Ash	AS05715	8/10/02	
0207044-13	10-OS	U-ISO	U-235	0.0191 +/- 0.0070	0.0056	pCi/g	Ash	AS05715	8/10/02	
0207044-13	10-OS	U-ISO	U-238	0.179 +/- 0.031	0.0039	pCi/g	Ash	AS05715	8/10/02	

Comments:

Data Package ID: *U0207044-1*

Qualifiers/Flags:
U - Result is less than the sample specific MDC.
LT - Result is less than Requested MDC, greater than sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.

Abbreviations:
TPU - Total Propagated Uncertainty (see PAI SOP 743)
MDC - Minimum Detectable Concentration (see PAI SOP 709)

APPENDIX C. HISTORICAL RADIONUCLIDE DATA FOR SOILS AND VEGETATION COLLECTED AT REGIONAL BACKGROUND SAMPLING LOCATIONS

In an attempt to isolate historical institutional influences on radionuclides in the environment, soil and vegetation samples are collected at background areas located away from LANL, where radionuclide concentrations result from naturally occurring elements and/or from worldwide fallout. These radionuclide concentrations are expressed as annual RSRL values (mean concentration of a radionuclide over a 5-year time frame plus two standard deviations), representing the upper limit (95% confidence interval) of naturally occurring elements and/or from worldwide fallout. The final objective is to compare all of the samples collected around and in Area G that are above these RSRL values to estimate institutional effects alone.

The RSRL values for several radionuclides in soils are presented in Figure C-1. Except for ^{3}H, radionuclide RSRL concentrations tend to be quite similar with time, but do vary in value by four orders of magnitude from radionuclide to radionuclide. For example, the 23 $^{239,240}Pu$ RSRL concentrations shown in Figure C-1 had a minimum and maximum value of 0.019 and 0.033 pCi/g, respectively, and a coefficient of variation of only 20%.

In comparison, soil ^{3}H RSRL concentrations started decreasing with time in 1992 (Figure C-1). Thus, the 23 ^{3}H RSRL concentrations exhibited maximum and minimum values of 9.3 and 0.61, respectively, exhibiting a coefficient of variation of 78%.

A recent study of regional background radioactivity in river and reservoir sediments (McLin and Lyons, 2002) pointed out that prior to 1987, unreliable ^{3}H measurements were reported (Rogers, 1998) because of possible airborne releases at the Laboratory that resulted in cross-contamination of samples during analyses. Thus, inclusion of questionable data tends to increase the respective means and standard deviations of individual radionuclides. However, for our purposes of comparing soil ^{3}H concentrations for samples collected at Area G to RSRL values, this was accomplished using the pre-1992 values shown in Figure C-1.

The radionuclide concentrations in overstory and understory vegetation samples collected from 1994 to 2002

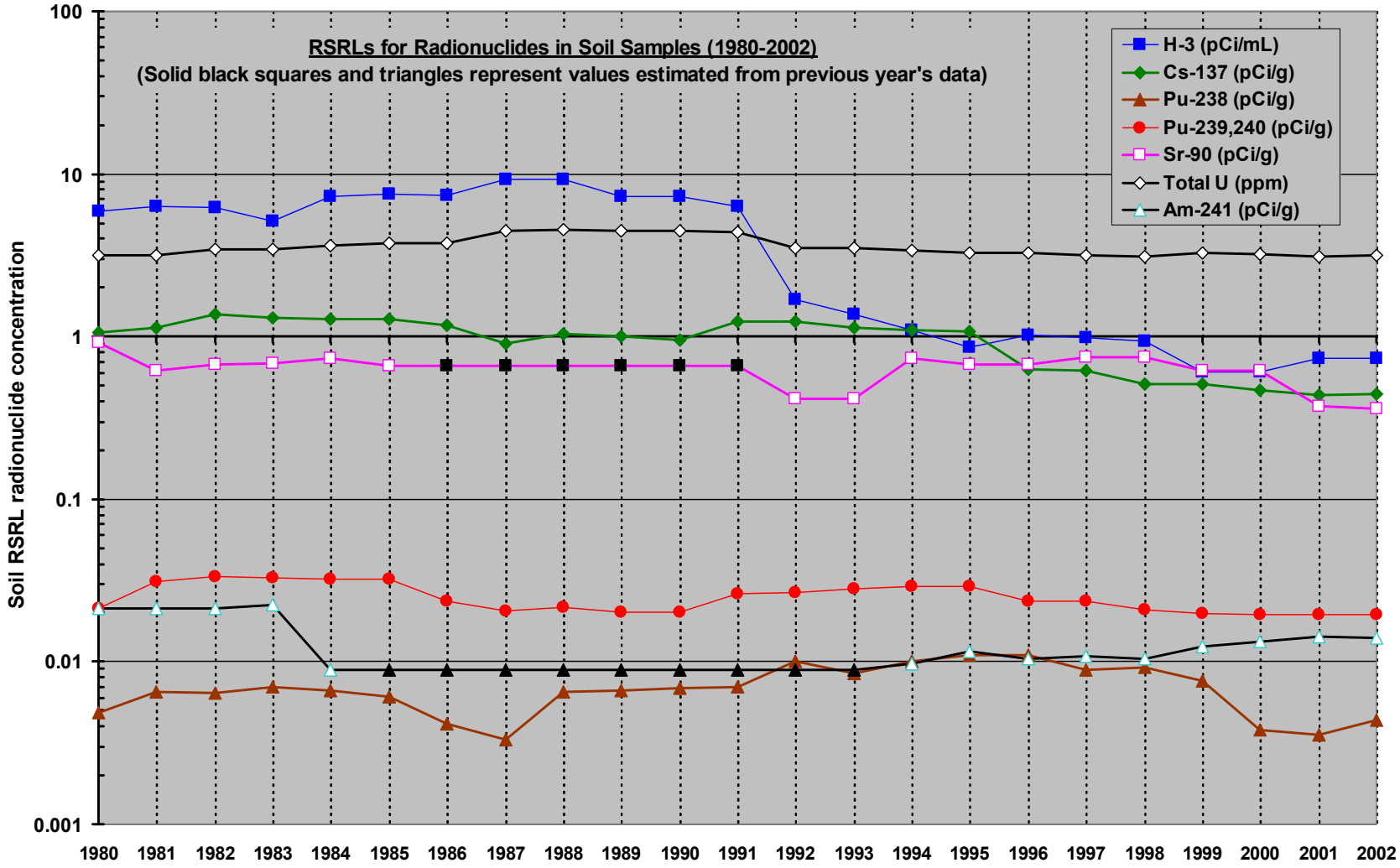

Figure C-1. Estimates of RSRL for soil radionuclides from regional background stations from 1980 through 2002.

(Table C-1) were used to estimate RSRL values for the vegetation from the Regional Background sampling stations Figures C-2 and C-3). This represents the first comprehensive evaluation of vegetation RSRLs at Los Alamos. Since each RSRL estimate is derived from a mean radionuclide concentration for the current year plus the four previous years, the first RSRL estimates were for 1998, since the first data for vegetation was collected in 1994.

Table C-1. Description of vegetation sampling studies since 1994 at regional background stations.

Year	Sample locations	Number of samples collected		Sample designation	References
		OS[1]	US[1]		
1994	Santa Fe	1	1	Overstory and Understory Regional Background samples	Fresquez et al., 1995
1995	Santa Fe	1	1	Overstory and Understory Regional Background samples	Fresquez et al. , 1996a
1996	Bandelier	1	1	Sample 9 (BG)	Fresquez et al., 1997b
1997	Bandelier	1	1	Sample 9 (BG)	Fresquez, 1998
1997	Espanola, Santa Fe, Jemez	1	0		Fresquez, 1998
1998	Bandelier	1	1	Sample 9 (BG)	Fresquez et al., 1999b
1998	Espanola, Santa Fe, Jemez	1	0	Espanola/Santa Fe/Jemez Regional Background	Fresquez et al., 1999a
1998	Embudo, Cochiti, Jemez	3	3	Regional Background	Gonzales et al., 2000b
1999	Bandelier	1	1	Sample 9 (BG)	Nyhan et al. (2000)
1999	Espanola, Santa Fe, Jemez	1	0	Espanola/Santa Fe/Jemez Regional Background	Fresquez et al., 2000

Table C-1. Description of vegetation sampling studies since 1994 at regional background stations (Cont.).

Year	Sample locations	Number of samples collected		Sample designation	References
		OS[1]	US[1]		
2001	Bandelier	1	1	Sample 9 (BG)	Nyhan et al., 2002
2002	Bandelier	1	0	Sample 9 (BG)	Nyhan et al., 2003 (this report)
2002	Embudo, Cochiti, Jemez	3	3	Regional Background	Fresquez et al., 2003

[1]OS and US signify overstory (tree) and understory (grass and shrubs).

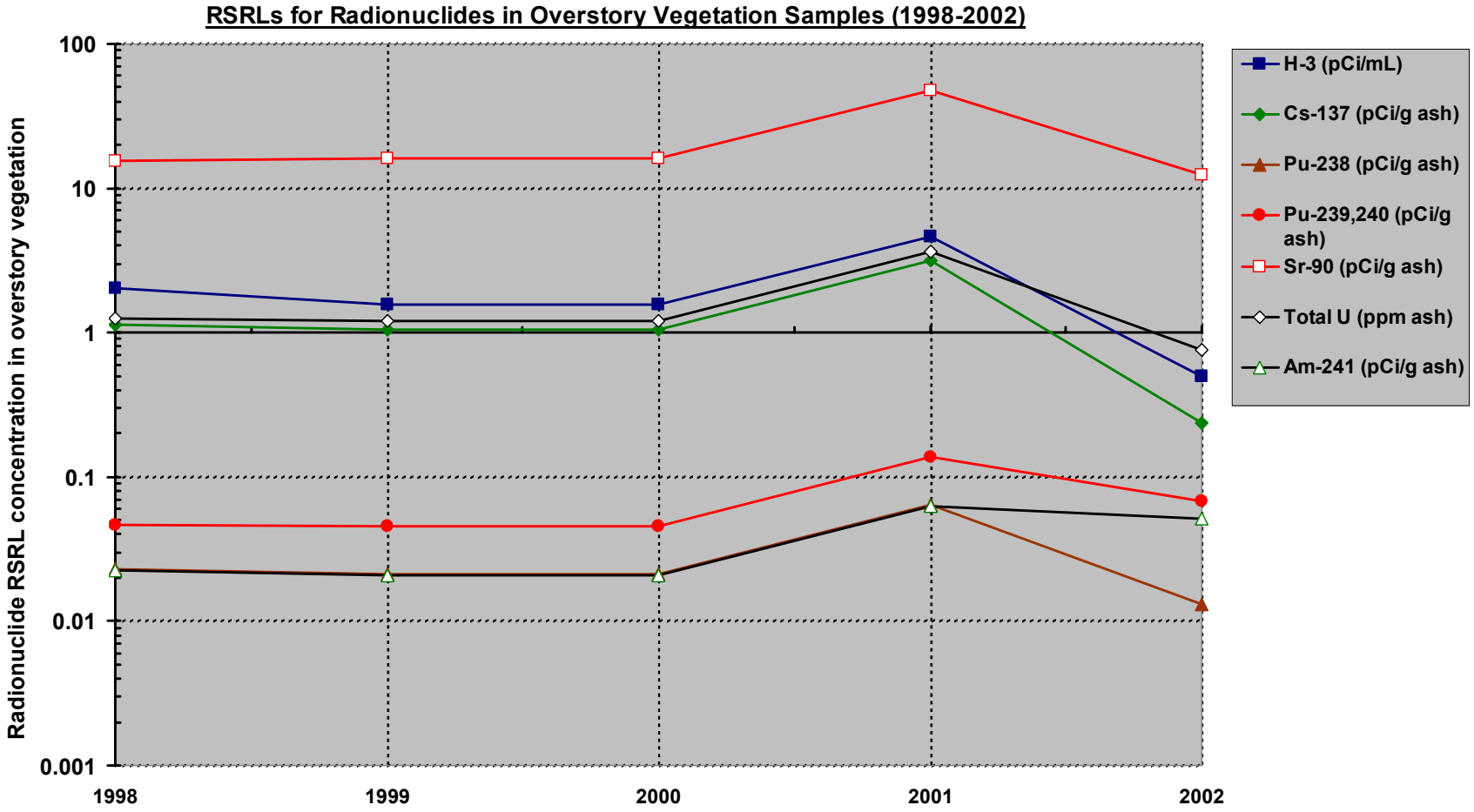

Figure C-2. Estimates of RSRL for radionuclides in overstory vegetation from regional background stations.

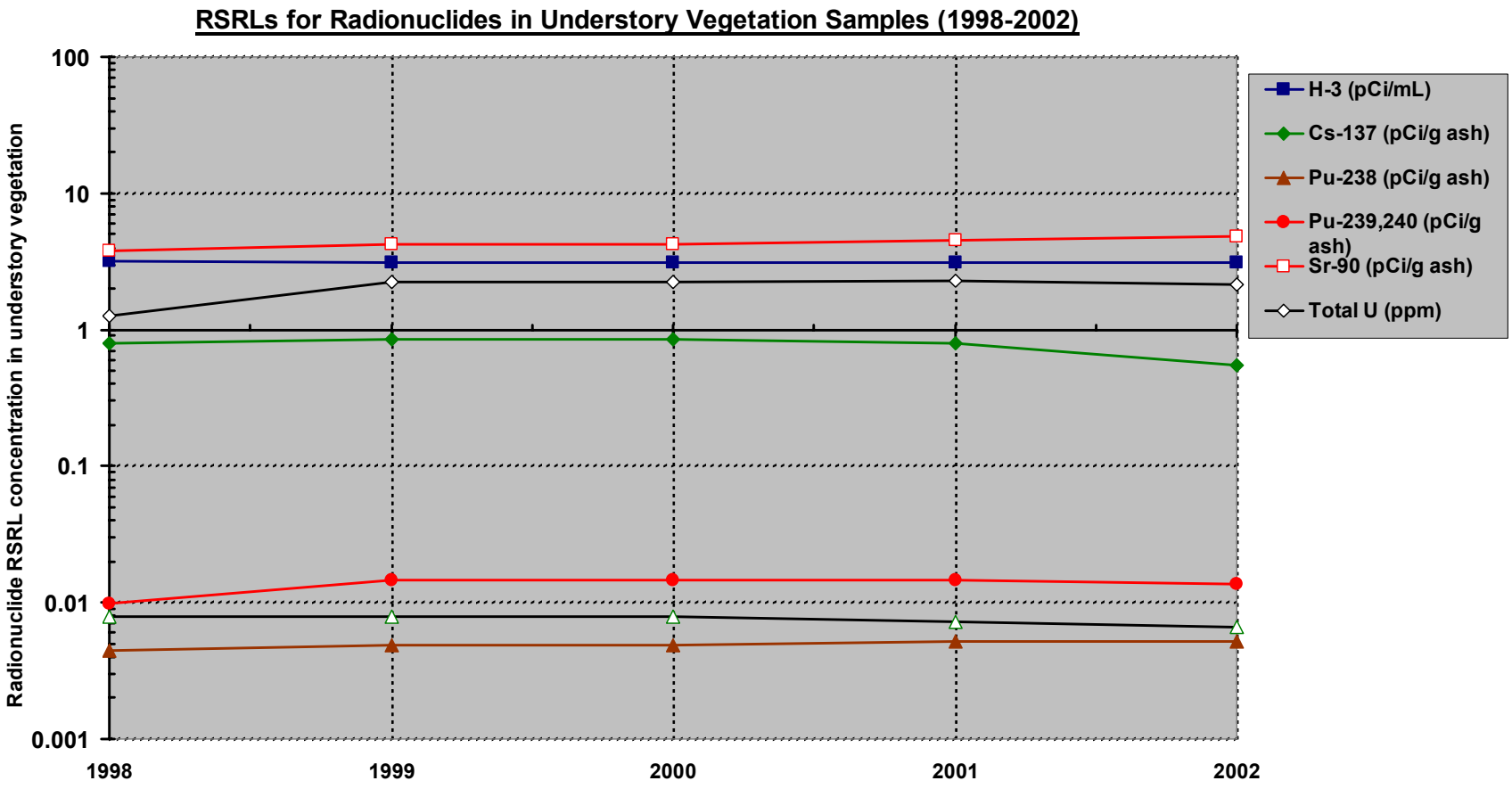

Figure C-3. Estimates of RSRL for radionuclides in understory vegetation from regional background stations.

APPENDIX D. RADIONUCLIDE CONCENTRATIONS IN AREA G SOILS SINCE 1980

Table D-1. ^{3}H concentrations in Area G soils (pCi/mL).

Stations Outside Area G: Southwestern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
9								0.13	-0.45	0.25	0.13	0.08	0.31	1.0
8								-0.41	-0.13	1.15	0.13	0.3	0.54	1.7
G-13-01					0.3	1.0								
G-14-01					1.5	0.6								
G-15-01					1.3	0.8								
G-15-02						1.6		0.2						
G-16-01					3.0	2.1								
G-17-01						1.8								
H-1		1.0	5.1											
16,1				0.5										
G-17-02					3.1	2.4								
G-17-03					0.8	2.1								
15,2				0.4										
G-18-01					1.3	1.4								
G-18-03					0.0									
G-19-01					1.4	1.2								
14,2				0.6										
G-19-02						2.5								
G-20-01					3.5	5.5								
13,1				1.1										

Table D-1. ^{3}H concentrations in Area G soils (pC/mL) (Cont.).

Stations Outside Area G: Southwestern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-20-02					5.1	4.4								
H-2		2.0	2.1											
G-21-01						2.6								
G-21-02					1.9									
G-22-01					3.7	3.6								
H-3		3.9	3.2											
G-23-01						2.2								
G-23-02						8.6								
H-4		1.2	2.2											
G-24-01						2.5								
G-24-02					0.1	2.5								
G-25-01						2.6								
12,3				0.6										
G-26-01						3.3								
11,4				1.6										
H-5		2.4	2.6											
G-27-01						13.3								
G-28-01					0.1	20.0								
H-6		7.8	2.0											
G-28-02					0.1	30.8								
G-28-03					0.1									

Table D-1. ^{3}H concentrations in Area G soils (pCi/mL) (Cont.).

Stations Outside Area G: Southwestern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
10,3				1.3										
G-15	13.0													
G-29-01					1.0	253.3	43.3	70.2	8.8	19.1	13.8			
2								171.18	49.79	147.5	81.9	206	616	273.0
10,4				2.2										
G-29-02					2.2	1097.6	60.0	316.4	19.3	15.0	24.9			
G-29-03					11.7	1715.6	90.5	716.0	67.4	162.7	226.5	3422	1450	22000.0
H-7		31.0	3.5											
9,5				1300										
G-12	12.9													
1								43.18	36.9	115	65.1	255	411	370.0
G-30-01					2.0	205.3	83.6	47.4	29.6	9.7	69.9			

Stations Outside Area G: Southern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-31-01					11.4	404.1	33.7	47.4	111.0	33.7	32.1	276	910	470.0
G-31-02					1.0	202.0	71.9	118.7	82.6	15.0	16.3			
H-8		9.4	4.3											
G-31-03					0.5	115.7	69.1	27.5	19.9	6.5	10.2			
7,5				11										

Table D-1. ^{3}H concentrations in Area G soils (pCi/mL) (Cont.).

Stations Outside Area G: Southern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-32-01					2.0	53.8	32.1	14.1	31.4	5.5	11.3			
G-32-02					0.8	47.2	24.3	8.6	13.8	2.9	4.88			
G-32-03					0.5	31.1	16.1	8.0	4.9					
G-33-01					0.3	14.1								
G-11	5.6													
H-9		6.3	2.9											
G-34-01						6.3								
G-34-02					0.1	4.7								
G-34-03					0.1	3.9								
G-34-04					0.1	4.2	4.5	1.6	0.6					
H-10		1.5	97.0											
G-35-02					5.7	8.7								
G-35-01					3.0	5.5								
H-11		0.6	7.0											
G-36-02					2.8	3.1								

Stations Outside Area G: Eastern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-36-01					1.4	2.7								
G-10	4.9													

Table D-1. ^{3}H concentrations in Area G soils (pCi/mL) (Cont.).

Stations Outside Area G: Eastern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
H-12		0.9	6.8											
G-38-01					2.6	3.9								
G-38-02					127.6	79.6	15.1	19.9	22.7	8.9	2.38			
G-39-02					3.6	8.1	2.9	1.6	2.3	8.1	0.76			
6b											0.53	0.57	2.8	2.0
G-39-01					0.8	11.4	1.8	2.7	1.5	4.1	0.41			
H-13		0.7	3.8											
G-9	31.2													
G-40-01					3.1	4.5	1.6	1.9	0.8	4.6	0.98			
G-40-02					2.6	3.0	1.7	1.5	0.9	11.5	0.68			
G-41-02					2.3	3.2	0.5	1.9	0.6	5.3	0.67	0.44	10.2	4.8
H-14		0.6	3.8											
G-13	33.1													
G-42-01					5.4	5.1	1.6	2.5	1.3	4.1	1.57			

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1,1				15										
4									1.07	7.4	1.91	0.68	6	3.3
G-42-06							1.7	4.6		2.4	1.71			

Table D-1. ^{3}H concentrations in Area G soils (pCi/mL) (Cont.).

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-43-01					11.7	8.2	7.2		1.3	2.1	0.91	0.65	20.9	6.4
G-43-02					6.3	9.2								
G-44-07								13.9	1.9		0.62			
G-45-04							14.0	18.5	2.5		1.69			
G-45-05							3.6	18.5	3.1		0.65			
G-44-01					110.8	158.6				4.2	3.97			
G-45-06							105.0	34.3	2.5	1.3	4.27			
G-45-01					117.2	436.6				26.3	7.9			
G-45-07							35.7	38.3	2.8	2.4	6.8			
H-15		4.6	4.9							2.9				
G-14	78.2									25.7				
G-46-01					18.8	49.4	1.9	23.0	6.2	2.0	1.2			
G-46-02					21.1	27.8	2.5	9.9	1.0	4.4	1.24			
G-44-02							5.0			1.4				
G-47-01					7.1	4.8	1.3	7.2	2.1	1.5	0.42			
7c											2.24	1.92	7.5	6.9
G-1	5.9													
G-48-01					5.5	5.4								
G-48-02					5.9	5.1			1.3	1.2	0.15	2.1	19	8.3
G-48-03					16.1	5.0								
G-48-04						5.1								

Table D-1. ^{3}H concentrations in Area G soils (pCi/mL) (Cont.).

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-49-01					1.1	1.9	1.2	1.3	1.2	0.8	0.78			
G-49-02							1.1							
G-49-04								1.6	0.9	1.3	0.53			
G-50-01					20.7	31.2	2.6	5.2	0.5	1.8	0.55			
G-50-02					7.6	30.1	1.7	3.6	1.1	1.2	0.83			
G-50-03											0.17			
H-16		1.3	74.0											
G-51-01					39.1	5.4								
G-52-03					3.0	5.6	1.9	17.0	0.5	1.4				
G-52-01					2.1	4.2	1.4	1.8	0.3					
G-52-02					2.3	6.0	1.2	0.8	0.8					
G-53-02							3.8							
G-53-01					1.0	2.3	0.3							
G-54-01					1.9	6.8	0.4							
G-54-02					1.2	3.9	0.6							
G-55-01					1.0	3.5	0.3		0.6					
3b											0.08	1.02	2.82	6.7
G-57-01					0.5	1.9	0.2							
G-58-03														
G-58-01					4.3	2.4	2.2	0.6	0.1	3.8	0.47	1.02		6.3
G-59-01						1.3	0.2							

Table D-1. ^{3}H concentrations in Area G soils (pCi/mL) (Cont.).

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-60-01						0.9	0.2							

Stations Inside Area G: in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-4	83.7													
7a								1.8		3.06	3.95	14.7	18	152.0
G-34-15						3.8				1.2	0.71			
G-34-14						4.1								
G-34-13						17.7	3.4	1.4	2.0					
G-34-12						4.1								
G-34-09						6.4	3.1	1.3		1.1	0.14			
G-7	5.8													
G-34-06						2.9								
G-34-05						8.2	5.0	1.5		0.5	0.27			
G-34-08						4.2								
G-34-11						4.0								
G-34-07						5.1	2.3	1.5	1.1		0.17			
G-34-10						3.8	1.7	1.7	1.4	2.1	0.15			
G-2	80.4													
G-6	30.9													
6								18.1	11.37					

Table D-1. ^{3}H concentrations in Area G soils (pCi/mL) (Cont.).

Stations Inside Area G: in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
5								7.89	12.81	39.9	13.3	506		
G-5	194.5													
G-8	13.2													
7b									1.78	6.4	3.41	6.52	6	6.1
G-3	3.5													
3								1.21	0.52	2.42	1.54	2.37	2.83	7.2

Table D-2. ^{241}Am concentrations in Area G soils (pCi/g).

Stations Outside Area G: Southwestern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
9									0.007	0.006	0.011	0.007	0.0057	0.0056
8									0.007	0.008	0.011	0.024	0.0056	0.0064
G-13-01					0.0010	0.007								
G-14-01					0.0090	0.013								
G-15-01					-0.0120	0.014								
G-15-02					-0.0240	0.018								
G-16-01					0.0220	0.011								
G-17-01					0.019	0.008								
H-1			0.86											
G-17-02					0.0002	0.021								
G-17-03					0.0140	0.013								
G-18-01					0.0370	0.010								
G-18-03					0.0279									
G-19-01					0.0834	0.134								
G-19-02						0.008								
G-20-01					-0.0240	0.017								
G-20-02					-0.0180	0.006								
H-2			0.51											
G-21-01					-0.0030	0.013								
G-21-02					0.0040									

Table D-2. ^{241}Am concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Southwestern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-22-01					0.0050	0.003								
H-3			0.89											
G-23-01					0.0160	0.003								
G-23-02					-0.0091	0.015								
H-4			0.62											
G-24-01					0.0949	0.007								
G-24-02					0.5520	0.010								
G-25-01					0.1160	0.021								
G-26-01					0.1510	0.018								
H-5			0.87											
G-27-01					0.0757	0.017								
G-28-01					0.1070	0.010								
H-6			0.54											
G-28-02					0.2300	0.015								
G-28-03					0.0915									
G-29-01					0.1320	0.009	-0.15	0.08	0	0.23	0.402			
2									0.008	0.007	0.006	0.017	0.013	0.0053
G-29-02					0.1230	0.018	0	0.14	-0.07	0.24	0.522			
G-29-03					0.1910	0.006	0.01	0.19	-0.01	0.09	0	0.006	0.019	0.0081

Table D-2. ^{241}Am concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Southern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
H-7			1.02											
1									0.007	0.009	0.011	0.012	0.0053	0.0088
G-30-01					0.2180	0.007	0.07	0.61	0.04	0.39	0.155			
G-31-01					0.1090	0.032	-0.02	0.20	0.07	0.04	0	0.022	0.028	0.0071
G-31-02					0.0940	0.006	0	0.00	0.04	0.92	0.91			
G-31-03			0.64		0.1240	0.006	0.05	1.07	-0.05	0.03	0.32			
G-32-01					0.0604	0.076	0.11	0.02	0.03	0.45	0.73			
G-32-02					0.1960	0.010	0.05	0.13	-0.03	0.09	0.461			
G-32-03					0.0957	0.025	0.03	0.16	-0.05					
G-33-01					0.0567	0.020								
G-34-01			0.22		0.0643	0.008								
G-34-02					0.2070	0.016								
G-34-03					0.0185	0.008								
G-34-04					-0.0241	0.016	0	1.10	-0.07					
G-35-02			0.65		0.305	0.053								
G-35-01					0.335	0.084								
G-36-02			0.29		0.6400	0.015								

Stations Outside Area G: Eastern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-36-01					1.0800	0.053								

Table D-2. ^{241}Am concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Southern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
H-12			0.71											
G-38-01					0.215	0.014								
G-38-02					0.265	0.181	0.14	0.32	-0.01	0.94	0.753			
G-39-02					0.22	0.021	0.08	0.11	0.01	0.14	0.173			
6b											0.062	0.256	0.174	0.0300
G-39-01					0.28	0.042	0.03	13.10	0.21	0.49	0.335			
H-13			nd											
G-40-01					0.105	0.068	0.09	0.55	0.16	0.42	0.479			
G-40-02					0.085	0.059	0.22	0.15	0	0.17	0.31			
G-41-02					0.13	0.051	0.14	0.76	0.15	0.45	0.311	0.177	0.105	0.1400
H-14			0.85											
G-42-01					0.125	0.082	0.08	0.27	0.12	-0.30	0.322			

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1,1														
4									0.113	0.15	0.146	2.03	0.079	0.2100
G-42-06							0.08	0.14		1.10	0.136			
G-43-01					0.22	0.249	0.40		0.36	1.51	0.331	0.079	0.065	0.3700
G-43-02					0.15	0.119								
G-44-07								0.21	0.15	0.02	0.163			

Table D-2. ^{241}Am concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-45-04							0.74	0.37	-0.02	0.40	0			
G-45-05							0.69	0.50	0.18	0.93	0.271			
G-44-01					0.255	0.242				1.10	0.338			
G-45-06							0.12	0.09	0.05	-0.09	0.15			
G-45-01					0.215	0.270				0.08	0.387			
G-45-07							0.63	0.02	0.04	0.27	0.417			
H-15			0.63											
G-14														
G-46-01					0.3300	0.336	0.34	1.09	0.43	0.21	0.773			
G-46-02					0.125	0.249	0.92	0.88	0.21	0.28	2.78			
G-44-02							0.97							
G-47-01					0.5400	0.242	0.89	0.09	0.25	0.46	0.169			
7c											0.141	0.125	0.179	0.0500
G-1														
G-48-01					0.1620	0.05								
G-48-02					0.5200	0.103			0.12	1.67	0	0.176	0.39	0.1600
G-48-03					0.4690	0.126								
G-48-04						0.103								
G-49-01					0.6770	0.055	0.61	0.19	0.01	0.63	0.416			
G-49-02							0.42							

Table D-2. ^{241}Am concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-49-04								0.03	0.16	-0.14	1.11			
G-50-01					1.0200	1.546	0.30	0.09	0.43	1.23	1.34			
G-50-02					0.4000	0.102	0.67	0.54	0.09	0.55	0.397			
H-16			0.74											
G-51-01					0.2570	0.015	0.90							
G-52-03					0.0100	0.02	0.51	0.09	0.22	1.70	0.252			
G-52-01					0.0080	0.008		0.14	0.06					
G-52-02						0.007	0.32	0.01	0.43					
G-53-02					0.1830		0.49							
G-53-01					204	0.014	0.01							
G-54-01					0.1510	0.007	-0.01							
G-54-02					-0.1030	0.012	0.04							
G-55-01					0.1670	0.014	-0.03		-0.03					
3b											0.003	0.006	0.0076	0.0100
G-57-01					0.1830	0.012	0.02							
G-58-01					0.1120	0.008	0.01	0.09	-0.03	0.59	0.526	0	0.012	0.0091
G-59-01						0.01	0.02							
G-60-01						0.009	-0.06							
7a										0.007	0.005	0.023	0.0033	0.0033
G-34-15						0.011				1.10	0.75			
G-34-14						0.006								

Table D-2. ^{241}Am concentrations in Area G soils (pCi/g) (Cont.).

Stations Inside Area G: in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
7a										0.007	0.005	0.023	0.0033	0.0033
G-34-15						0.011				1.10	0.75			
G-34-14						0.006								
G-34-13						0.012	0.01	0.90	-0.05					
G-34-12						0.006								
G-34-09						0.012	0.07	1.08		2.01	0.649			
G-34-06						0.015								
G-34-05						0.017	0.23	0.13		1.11	0.85			
G-34-08						0.033								
G-34-11						0.090								
G-34-07						0.007	0.19	0.16	0.04		0.806			
G-34-10						0.412	0.12	1.08	0.26	1.07	1.1			
6									0.007					
5									0.013	0.007	0.008	0.068		
G-5												0.022		
7b									0.011	0.016	0.009	0.002	0.019	0.0075
3									0.015	0.017	0.023		0.028	0.0200

Table D-3. ^{238}Pu concentrations in Area G soils (pCi/g).

Stations Outside Area G: Southwestern side, in order of occurrence along fence

Sampling Station	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
9							0.000	0.001	0.001	0	0.001	-0.001	-0.0009
8							0.001	0.008	0.000	0.009	0.038	0.003	0.0023
G-13-01				0.0030	0.000								
G-14-01				0.0060	0.007								
G-15-01				0.0014	0.016								
G-15-02				0.0070	0.015								
G-16-01				0.0120	0.004								
G-17-01				0.004	0.004								
H-1	0.0007	0.003											
16,1			0.0068										
G-17-02				0.0110	0.009								
G-17-03				0.0080	0.004								
15,2			0.0018										
G-18-01				0.0050	0.004								
G-18-03				0.0110									
G-19-01				0.0020	0.011								
14,2			0.0028										
G-19-02					0.003								
G-20-01				0.0150	0.009								
13,1			0.0081										
G-20-02				0.0090	0.003								

Table D-3. ^{238}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Southwestern side, in order of occurrence along fence

Sampling Station	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
H-2	0.0054	0.002											
G-21-01				0.0080	0.014								
G-21-02				0.0120									
G-22-01				0.0050	0.005								
H-3	0.0076	0.010											
G-23-01				0.0070	0.002								
G-23-02				0.0320	0.007								
H-4	0.0063	0.005											
G-24-01				0.0380	0.005								
G-24-02				0.0070	0.006								
G-25-01				0.0070	0.007								
12,3			0.0112										
G-26-01				0.0090	0.006								
11,4			0.0046										
H-5	0.0051	0.006											
G-27-01				0.0050	0.004								
G-28-01				0.0030	0.004								
H-6	0.0220	0.003											
G-28-02				0.0110	0.009								
G-28-03				0.0630									
10,3			0.135										

Table D-3. ^{238}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Southwestern side, in order of occurrence along fence

Sampling Station	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-29-01				0.0590	0.023	0.059	0.022	0.022	0.017	0.031			
2							0.004	0.004	0.003	0.006	0.008	0.011	0.0046
10,4			0.0209										
G-29-02				0.0070	0.026	0.053	0.022	0.016	0.004	0.016			
G-29-03				0.0130	0.005	0.012	0.002	0.003	0.010	0.022	0.003	0.024	0.0041
H-7	0.0057	0.000											
9,5			0.0105										
1							0.011	0.005	0.007	0.015	0.004	0	0.0023
G-30-01				0.0410	0.009	0.007	0.011	0.036	0.015	0.004			

Stations Outside Area G: Southern side, in order of occurrence along fence

Sampling Station	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-31-01				0.0230	0.024	0.035	0.014	0.015	0.033	0.032	0.006	0.009	0.0069
G-31-02				0.0040	0.009	0.013	0.012	0.006	0.011	0.007			
H-8	0.0034	0.002											
G-31-03				0.0040	0.007	0.003	0.006	0.005	0.002	0.004			
7,5			0.0388										
G-32-01				0.0070	0.022	0.006	0.007	0.014	0.005	0.003			
G-32-02				0.0070	0.007	0.011	0.007	0.011	0.007	0.007			
G-32-03				0.0120	0.010	0.034	0.007	0.005					
G-33-01				0.0090	0.016								

Table D-3. ^{238}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Southern side, in order of occurrence along fence

Sampling Station	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
H-9	0.0033	0.007											
G-34-01				0.0070	0.006								
G-34-02				0.0020	0.005								
G-34-03				0.0010	0.004								
G-34-04				0.0230	0.020	0.029	0.025	0.019					
H-10	0.0139	0.014											
G-35-02				0.0040	0.016								
G-35-01				0.0130	0.010								
H-11	0.0064	0.002											
G-36-02				0.0020	0.005								

Stations Outside Area G: Eastern side, in order of occurrence along fence

Sampling Station	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-36-01				0.0300	0.009								
G-10													
H-12	0.1920	0.014											
G-38-01				0.0410	0.005								
G-38-02				0.0650	0.211	0.078	0.051	0.055	0.081	0.07			
G-39-02				0.0520	0.042	0.085	0.031	0.045	0.061	0.085			
6b										0.014	0.033	0.032	0.010

Table D-3. ^{238}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Eastern side, in order of occurrence along fence

Sampling Station	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
H-13	1.0690	0.090											
G-40-01				3.2980	2.489	1.309	2.65	0.79	0.621	0.294			
G-40-02				2.0450	3.434	1.731	0.511	2.4	2.064	0.079			
G-41-02				1.4850	1.163	2.182	1.810	0.78	2.226	0.869	5.22	2.13	1.92
H-14	0.3830	1.200											
G-13													
G-42-01				2.1100	0.385	1.420	0.654	1.18	0.261	1.797			

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1,1			0.171										
4							0.013	0.246	0.272	0.364	0.39	0.189	0.53
G-42-06						0.120	0.113		0.097	0.055			
G-43-01				0.5160	0.574	0.277		1.28	0.507	0.571	0.19	0.187	0.27
G-43-02				0.2860	0.508								
G-44-07							0.208	0.124	0.118	0.05			
G-45-04						0.964	0.571	0.54	0.238	0.322			
G-45-05						0.303	0.243	0.23	0.413	0.744			
G-44-01				1.1340	15.778				0.101	0.445			
G-45-06						0.231	0.059	1.74	1.736	0.225			

Table D-3. ^{238}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-45-01				4.9870	1.260				2.519	0.439			
G-45-07						10.700	0.246	0.57	0.492	3.279			
H-15	1.8950	0.612											
G-46-01				2.1520	16.683	7.760	2.866	4.89	1.303	0.005			
G-46-02				2.3140	1.863	1.971	2.462	1.86	1.942	0.262			
G-44-02						0.626							
G-47-01				0.1260	0.078	0.111	0.134	0.129	0.234	0.001			
7c										0.091	0.149	0.126	0.0300
G-48-01				0.0990	0.131								
G-48-02				0.1490	0.081			0.050	0.077	0.017	0.134	0.214	0.1800
G-48-03				0.1850	0.085								
G-48-04					0.081								
G-49-01				0.1060	0.028	0.044	0.005	0.032	0.038	0.035			
G-49-02						0.022							
G-49-04							0.018	0.018	0.011	0.012			
G-50-01				0.0830	0.142	0.062	0.027	0.057	0.016	0.015			
G-50-02				0.0900	0.033	0.038	0.068	0.043	0.028	0.053			
H-16	0.0276	0.620											
G-51-01				0.0350	0.017	0.014							
G-52-03				0.0400	0.031	0.028	0.042	0.034	0.016	0.054			

Table D-3. ^{238}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Northern side, in order of occurrence along fence

Station	Sampling 1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-52-01				0.0070	0.006		0.021	0.022					
G-52-02					0.009	0.005	0.028	0.027					
G-53-02				0.0160		0.019							
G-53-01				0.0120	0.015	0.010							
G-54-01				0.0150	0.016	0.016							
G-54-02				0.0110	0.008	0.009							
G-55-01				0.0090	0.007	0.004		0.002					
3b										0.002	0.004	0.011	0.0069
G-57-01				0.0090	0.008	0.011							
G-58-01				0.0380	0.052	0.025	0.032	0.016	0.049	0.084	0.004	0.008	0.0039
G-59-01					0.005	0.004							
G-60-01					0.003	0.004							

Stations Inside Area G: in order of occurrence along fence

Station	Sampling 1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
7a							0.007		0.003	0.005	0.044	0.029	0.0100
G-34-15					0.157				0.222	0.215			
G-34-14					0.098								
G-34-13					0.259	0.212	0.112	0.141					
G-34-12					0.006								
G-34-09					0.008	0.017	0.004		0.018	0.005			

Table D-3. ^{238}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-34-06					0.017								
G-34-05					0.050	0.008	0.022		0.012	0.02			
G-34-08					0.008								
G-34-11					0.052								
G-34-07					0.009	0.006	0.001	0.002		0.005			
G-34-10					0.106	0.028	0.079	0.037	0.040	0.039			
6							0.007	0.135					
5							0.007	0.007	0.001	0.002	0.012		
G-5											0.006		
7b								0.004	0.004	0.035	0.015	0.006	0.0081
3							0.021	0.019	0.034	0.012		0.008	0.0100

Table D-4. ^{239,240}Pu concentrations in Area G soils (pCi/g).

Stations Outside Area G: Southwestern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
9								0.015	0.018	0.011	0.02	0.01	0.02	0.0100
8								0.013	0.357	0.008	0.02	0.149	0.017	0.0200
G-13-01					0.0080	0.020								
G-14-01					0.0090	0.008								
G-15-01					0.0200	0.043								
G-15-02					0.0470	0.060								
G-16-01					0.0520	0.019								
G-17-01					0.0130	0.006								
H-1		0.008	0.030											
16,1				0.0244										
G-17-02					0.0770	0.079								
G-17-03					0.0210	0.029								
15,2				0.0031										
G-18-01					0.0150	0.024								
G-18-03					0.0150									
G-19-01					0.0150	0.037								
14,2				0.0032										
G-19-02						0.010								
G-20-01					0.0440	0.038								
13,1				0.0101										
G-20-02					0.0140	0.009								

Table D-4. ^{239,240}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Southwestern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
H-2		0.016	0.050											
G-21-01					0.0060	0.013								
G-21-02					0.0090									
G-22-01					0.0010	0.002								
H-3		0.029	0.083											
G-23-01					0.0070	0.007								
G-23-02					0.0270	0.042								
H-4		0.046	0.024											
G-24-01					0.0300	0.012								
G-24-02					0.0450	0.027								
G-25-01					0.0580	0.057								
12,3				0.0195										
G-26-01					0.0800	0.065								
11,4				0.0146										
H-5		0.187	0.020											
G-27-01					0.0330	0.033								
G-28-01					0.0060	0.023								
H-6		0.035	0.020											
G-28-02					0.0270	0.029								
G-28-03					0.0540									
10,3				0.0566										

Table D-4. ^{239,240}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Southwestern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-15	1.165													
G-29-01					0.0250	0.011	0.022	0.019	0.014	0.013	0.031			
2								0.042	0.024	0.016	0.027	0.05	0.022	0.0200
10,4				0.0174										
G-29-02					0.0250	0.045	0.028	0.029	0.029	0.016	0.055			
G-29-03					0.0120	0.015	0.014	0.013	0.008	0.029	0.033	0.013	0.025	0.0200
H-7		0.073	0.010											
9,5				0.0221										
G-12	0.230													
1								0.025	0.025	0.021	0.04	0.027	0.008	0.0200
G-30-01					0.0430	0.025	0.005	0.009	0.019	0.022	0.01			

Stations Outside Area G: Southern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-31-01					0.0650	0.117	0.079	0.048	0.032	0.025	0.106	0.082	0.027	0.0200
G-31-02					0.0100	0.010	0.020	0.015	0.005	0.012	0.007			
H-8		0.010	0.024											
G-31-03					0.0090	0.010	0.004	0.009	0.007	0.004	0.036			
7,5				0.0164										
G-32-01					0.0280	0.392	0.009	0.054	0.054	0.011	0.007			
G-32-02					0.0240	0.027	0.067	0.054	0.063	0.042	0.091			

Table D-4. ^{239,240}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Southern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-32-03					0.0270	0.058	0.021	0.027	0.021					
G-33-01					0.1070	0.122								
G-11	0.270													
H-9		0.055	0.027											
G-34-01					0.0180	0.012								
G-34-02					0.2010	0.046								
G-34-03					0.0180	0.040								
G-34-04					0.0360	0.050	0.034	0.053	0.031					
H-10		0.165	0.200											
G-35-02					0.0420	0.643								
G-35-01					0.1000	0.125								
H-11		0.079	0.010											
G-36-02					0.0140	0.034								

Stations Outside Area G: Eastern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-36-01					0.2160	0.122								
G-10	0.185													
H-12		4.080	0.018											
G-38-01					1.9440	0.031								

Table D-4. ^{239,240}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Eastern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-38-02					0.6910	0.982	1.132	0.452	0.63	2.109	1.048			
G-39-02					0.1310	0.068	0.114	0.052	0.085	0.145	0.179			
6b											0.334	0.947	0.79	0.1200
G-39-01					0.3500	0.203	0.231	0.168	0.12	0.095	0.557			
H-13		1.191	2.440											
G-9	0.050													
G-40-01					0.3200	0.281	0.169	0.763	0.45	0.152	0.489			
G-40-02					0.1890	0.295	0.267	0.074	0.156	0.179	0.164			
G-41-02					0.0620	0.156	0.206	0.180	1.71	0.260	0.313	1	0.479	0.5500
H-14		0.680	3.100											
G-13	1.000													
G-42-01					0.7270	1.031	0.736	0.661	0.62	0.136	0.206			

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1,1				0.237										
4								0.066	0.46	0.954	0.775	17.6	0.262	0.4100
G-42-06							6.290	0.130		0.150	0.295			
G-43-01					0.4400	1.814	0.558		0.38	0.599	4.26	0.295	0.314	0.6100
G-43-02					0.1640	0.711								
G-44-07								0.178	0.214	0.207	0.148			

Table D-4. ^{239,240}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-45-04							1.301	0.320	0.28	0.566	0.278			
G-45-05							0.378	0.428	0.55	1.615	0.894			
G-44-01					0.4330	0.588				0.077	0.372			
G-45-06							0.151	0.042	0.28	0.275	0.153			
G-45-01					0.3680	0.639				0.304	0.495			
G-45-07							1.200	0.119	0.22	0.347	0.524			
H-15		0.737	0.180											
G-14	0.895													
G-46-01					0.6090	1.173	1.060	0.314	1.58	0.272	1.597			
G-46-02					0.0730	1.093	0.825	0.450	0.93	0.690	0.284			
G-44-02							0.942							
G-47-01					3.4000	1.782	2.477	0.443	0.42	0.721	0.174			
7c											1.015	1.12	1.9	0.3400
G-1	1.555													
G-48-01					0.2370	0.297								
G-48-02					0.9230	0.579			0.520	0.583	0.222	1	2.85	0.7700
G-48-03					1.6130	1.157								
G-48-04						0.579								
G-49-01					2.0000	0.216	0.342	0.043	0.314	0.357	0.38			
G-49-02							0.092							
G-49-04								0.079	0.100	0.065	0.053			

Table D-4. ^{239,240}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-50-01					0.3150	1.063	0.211	0.067	0.161	0.069	0.073			
G-50-02					0.1780	0.075	0.048	0.072	0.099	0.050	0.106			
H-16		0.050	0.911											
G-51-01					0.0340	0.031	0.025							
G-52-03					0.0510	0.05	0.035	0.042	0.092	0.034	1.964			
G-52-01					0.0120	0.011		0.036	0.039					
G-52-02						0.031	0.012	0.053	0.068					
G-53-02					0.0240		0.023							
G-53-01					0.0300	0.043	0.020							
G-54-01					0.0310	0.019	0.025							
G-54-02					0.0300	0.033	0.035							
G-55-01					0.0140	0.044	0.015		0.013					
3b											0.016	0.026	0.014	0.0200
G-57-01					0.0690	0.037	0.093							
G-58-01					0.0190	0.025	0.033	0.016	0.019	0.007	0.043	0.008	0.032	0.0300
G-59-01						0.029	0.002							
G-60-01						0.022	0.009							

Stations Inside Area G: in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-4	0.100													

Table D-4. ^{239,240}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Inside Area G: in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
7a								0.013		0.007	0.012	0.073	0.004	0.0090
G-34-15						0.028				0.029	0.072			
G-34-14						0.022								
G-34-13						0.028	0.023	0.015	0.056					
G-34-12						0.007								
G-34-09						0.065	0.071	0.011		0.046	0.035			
G-7	0.220													
G-34-06						0.088								
G-34-05						0.049	0.007	0.061		0.052	0.079			
G-34-08						0.048								
G-34-11						0.542								
G-34-07						0.023	0.003	0.017	0.016		0.293			
G-34-10						2.773	0.199	1.620	1.205	1.338	1.68			
G-2	0.220													
G-6	0.470													
6								0.099	0.294					
5								0.022	0.026	0.007	0.013	0.424		
G-5	0.255											0.046		
G-8	0.040													
7b									0.017	0.025	0.027	0.055	0.1	0.0600
G-3	6.375													

Table D-4. ^{239,240}Pu concentrations in Area G soils (pCi/g) (Cont.).

Stations Inside Area G: in order of occurrence along fence

Sampling Station	1980	1985	1986	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
3								0.045	0.052	0.039	0.046		0.04	0.0400

Table D-5. ^{tot}U concentrations in Area G soils (ppm).

Stations Outside Area G: Southwestern side, in order of occurrence along fence

Sampling Station	1980	1985	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
9						3.6	2.85	1.92	3.27	2.06	3.15	2.9
8						3.609	2.85	5.45	3.16	3.45	2.96	3.0
G-13-01			2.20	3.8								
G-14-01			2.30	2.6								
G-15-01			3.00	5.0								
G-15-02			5.30	4.1								
G-16-01			3.20	3.4								
G-17-01			2.20	4.3								
H-1		4.6										
G-17-02			3.80	5.1								
G-17-03			3.30	4.4								
15,2												
G-18-01			3.10	5.2								
G-18-03			2.50									
G-19-01			2.60	5.0								
G-19-02				3.5								
G-20-01			2.40	4.5								
G-20-02			2.30	4.2								
H-2		3.9										
G-21-01			1.60	4.0								
G-21-02			2.80									

Table D-5. ^{tot}U concentrations in Area G soils (ppm) (Cont.).

Stations Outside Area G: Southwestern side, in order of occurrence along fence

Sampling Station	1980	1985	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-22-01			3.10	3.6								
H-3		2.9										
G-23-01			2.30	4.1								
G-23-02			2.20	4.0								
H-4		4.0										
G-24-01			2.10	3.8								
G-24-02			2.00	4.3								
G-25-01			4.50	4.9								
12,3												
G-26-01			4.30	4.8								
H-5		4.7										
G-27-01			3.50	4.2								
G-28-01			2.50	3.5								
H-6		3.3										
G-28-02			2.10	4.1								
G-28-03			2.50									
G-15	4.3											
G-29-01			1.90	2.8	2.98							
2						3.948	2.9	3.75	2.35	2.65	3.14	2.9
G-29-02			2.40	4.4	2.55							
G-29-03			2.90	4.4	2.57					0.22	3.32	2.9

Table D-5. ^{tot}U concentrations in Area G soils (ppm) (Cont.).

Stations Outside Area G: Southwestern side, in order of occurrence along fence

Sampling Station	1980	1985	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
H-7		4.5										
G-12	4.1											
1						4.059	2.65	3.69	2.37	2.53	3.05	3.2
G-30-01			3.20	3.3	1.6							

Stations Outside Area G: Southern side, in order of occurrence along fence

Sampling Station	1980	1985	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-31-01			3.60	4.3	3.31					3.01	3.14	2.6
G-31-02			2.40	3.0	2.06							
H-8		3.3										
G-31-03			2.00	3.0	1.99							
G-32-01			2.20	5.4	1.66							
G-32-02			2.80	4.1	3.24							
G-32-03			2.80	4.5	2.67							
G-33-01			3.40	4.4								
G-11	6.1											
H-9		4.1										
G-34-01			2.00	4.0								
G-34-02			2.80	4.4								
G-34-03			3.10	4.8								
G-34-04			2.70	4.4	3.02							

Table D-5. ^{tot}U concentrations in Area G soils (ppm) (Cont.).

Stations Outside Area G: Southern side, in order of occurrence along fence

Sampling Station	1980	1985	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
H-10		4.8										
G-35-02			2.20	4.1								
G-35-01			2.10	4.2								
H-11		3.9										
G-36-02			1.90	4.1								

Stations Outside Area G: Eastern side, in order of occurrence along fence

Sampling Station	1980	1985	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-36-01			2.20	5.1								
G-10	4.2											
H-12		4.3										
G-38-01			1.90	4.0								
G-38-02			1.70	4.5	2.75							
G-39-02			1.10	3.1	2.18							
6b									3.34	2.64	2.78	2.2
G-39-01			1.90	3.7	1.62							
H-13		6.6										
G-9	4.3											
G-40-01			2.30	5.1	2.1							
G-40-02			2.00	4.6	2.66							
G-41-02			2.80	4.4	2.44					3.96	3.84	3.7

Table D-5. ^{tot}U concentrations in Area G soils (ppm) (Cont.).

Stations Outside Area G: Eastern side, in order of occurrence along fence

Sampling Station	1980	1985	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
H-14		4.6										
G-13	4.5											
G-42-01			2.20	4.5	3							

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1980	1985	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
4						3.279	2.86	3.12	3.18	2.74	3.57	3.5
G-42-06					2.86							
G-43-01			2.50	4.2	2.95					2.86	2.9	3.1
G-43-02			2.10	3.9								
G-45-04					2.47							
G-45-05					2.25							
G-44-01			2.70	4.3								
G-45-06					2.42							
G-45-01			2.40	4.4								
G-45-07					3.09							
H-15		4.5										
G-14	5.1											
G-46-01			2.40	5.2	3.07							
G-46-02			2.50	4.5	2.57							
G-44-02					2.88							

Table D-5. ^{tot}U concentrations in Area G soils (ppm) (Cont.).

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1980	1985	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-47-01			2.40	3.7	2.39							
7c									2.58	2.5	3.18	2.5
G-1	4.6											
G-48-01			2.11	4.3								
G-48-02			2.05	4.8						2.61	3.18	3.0
G-48-03			1.87	4.3								
G-48-04				4.8								
G-49-01			2.58	2.7	2.11							
G-49-02					2.61							
G-50-01			2.24	3.8	2.93							
G-50-02			2.45	3.9	2.52							
H-16		4.1										
G-51-01			2.98	4.5	2.91							
G-52-03			2.38	3.9	2.49							
G-52-01			1.71	4.3								
G-52-02				3.2	1.97							
G-53-02			2.80		2.78							
G-53-01			2.91	4.5	2.39							
G-54-01			1.60	4.2	2.70							
G-54-02			1.77	4.1	2.95							
G-55-01			2.47	3.7	2.49							

Table D-5. ^{tot}U concentrations in Area G soils (ppm) (Cont.).

Stations Outside Area G: Northern side, in order of occurrence along fence

Sampling Station	1980	1985	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
3b									3.53	2.67	3.05	2.5
G-57-01			4.23	4.4	4.19							
G-58-01			2.65	4.2	2.36					1.32	3.11	3.0
G-59-01				5.4	3.51							
G-60-01				4.4	2.92							

Stations Inside Area G: in order of occurrence along fence

Sampling Station	1980	1985	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-4	4.1											
7a						3.735		4.47	2.8	3.11	2.94	3.2
G-34-15				3.7								
G-34-14				3.2								
G-34-13				4.1	2.19							
G-34-12				4.0								
G-34-09				4.7	3.1							
G-7	4.4											
G-34-06				4.7								
G-34-05				3.3	2.63							
G-34-08				4.8								
G-34-11				4.9								
G-34-07				3.8	2.21							

Table D-5. ^{tot}U concentrations in Area G soils (ppm) (Cont.).

Stations Inside Area G: in order of occurrence along fence

Sampling Station	1980	1985	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
G-34-10				4.7	2.21							
G-2	4.5											
G-6	4.2											
6						3.383	2.85					
5						3.077	2.97	2.19	2.47	1.74		
G-5	4.7									1.72		
G-8	3.8											
7b							2.9	4.35	2.37	3.06	2.76	3.2
G-3	4.7											
3						3.131	3.37	3.85	3.52		3.02	2.7

APPENDIX E. RADIONUCLIDE CONCENTRATIONS IN OVERSTORY VEGETATION COLLECTED AT AREA G SINCE 1980

Table E-1. ^{3}H concentrations in overstory vegetation at Area G (pCi/mL).

Samples collected outside of Area G

Sample Location	Sample Designation	1980	1985	1994	1995	1996	1997	1998	1999	2001
9	OS-9			1.2	0	-0.25	0.04	1.84	-0.11	0.32
8	OS-8					0.21	0.19	1.64	0.05	0.71
H-1	OS-H-1		0.40							
H-2	OS-H-2		0.30							
H-3	OS-H-3		0.40							
H-4	OS-H-4		1.60							
H-5	OS-H-5		3.30							
H-6	OS-H-6		17							
2	OS-2			5,800	418	7,569	207	8,740	678	256
H-7	OS-H-7		48							
G-12	OS-G-12	35.7								
1	OS-1			119.1	386	1,342	72	1,460	165.7	481
H-8	OS-H-8		0.12							
H-9	OS-H-9		1.30							
H-10	OS-H-10		10							
H-11	OS-H-11		6.10							
H-12	OS-H-12		6.60							
6b	OS-6b								0.61	0.77
H-13	OS-H-13		5.20							
G-9	OS-G-9	13.8								
G-9	OS-G-9	7.4								

Table E-1. ^{3}H concentrations in overstory vegetation at Area G (pCi/mL) (Cont.).

Samples collected outside of Area G

Sample Location	Sample Designation	1980	1985	1994	1995	1996	1997	1998	1999	2001
G-41-02	OS-G-41-02									
H-14	OS-H-14		3.90							
G-13	OS-G-13	14.4								
4	OS-4			2.5	4.3	0.87	1.13	9.60	5.14	2.27
H-15	OS-H-15		0.15							
7c	OS-7c								3.78	3.64
H-16	OS-H-16		26							
H-16	OS-H-16		2.80							
3b	OS-3b								-0.04	1.75

Stations Inside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1980	1994	1995	1996	1997	1998	1999	2001	2002
G-7	OS-G-7	2.6								
G-7	OS-G-7	10.2								
3	OS-3		9.2	2.8	0.71	0.86	6.70	2.15	3.71	8.80

Table E-2. ^{241}Am concentrations in overstory vegetation at Area G (pCi/g ash).

Stations Outside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1994	1997	1998	1999	2001	2002
9	OS-9	0.002	0.011	-0.002	0	0.044	
8	OS-8		0.015	0.011	-0.002	0	0.011
2	OS-2	0.003	0.031	0.035	0.015	0.283	122.00
1	OS-1	0.004	0.019	0.036	0.008	0.028	0.05
6b	OS-6b				0.275	0.006	0.412
G-41-02	OS-G-41-02						5.29
4	OS-4	0.008	0.110	0.017	0.115	0.019	
7c	OS-7c				0.019	0.003	0.047
3b	OS-3b				0	0.007	0.011

Stations Inside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1994	1997	1998	1999	2001	2002
3	OS-3	0.006	0.581	0.042	0.034	0.03	0.04

Table E-3. ^{238}Pu concentrations in overstory vegetation at Area G (pCi/g ash).
Stations Outside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1985	1994	1995	1996	1997	1998	1999	2001
9	OS-9		0	-0.001	0.025	0.001	-0.001	0.0002	0.0105
8	OS-8				0.001	0.000	-0.003	0.0005	0.0043
H-1	OS-H-1	0.003							
H-2	OS-H-2	0.020							
H-3	OS-H-3	0.068							
H-4	OS-H-4	0.006							
H-5	OS-H-5	0.013							
H-6	OS-H-6	0.016							
2	OS-2		0.003	0.003	0.002	0.004	-0.002	-0.0007	0.0179
H-7	OS-H-7	0.004							
1	OS-1		0.003	-0.001	0.001	0.002	0.007	-0.0001	0.0015
H-8	OS-H-8	0.009							
H-9	OS-H-9	0.004							
H-10	OS-H-10	0.011							
H-11	OS-H-11	0.006							
H-12	OS-H-12	0.042							
6b	OS-6b							0.0127	0.0008
H-13	OS-H-13	0.970							
H-14	OS-H-14	1.490							
4	OS-4		0.044	0.025	0.001	0.018	0.015	0.0004	-0.0002
H-15	OS-H-15	0.072							

Table E-3. ^{238}Pu concentrations in overstory vegetation at Area G (pCi/g ash) (Cont.).

Stations Outside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1985	1994	1995	1996	1997	1998	1999	2001
7c	OS-7c							0.0003	0.0031
H-16	OS-H-16	0.210							
H-16	OS-H-16	0.220							
3b	OS-3b							-0.0016	0.0038

Stations Inside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1994	1995	1996	1997	1998	1999	2001	2002
3	OS-3	0.028	0.009	0.011	0.130	0.014	0.0012	0.0061	0.0064

Table E-4. ^{239,240}Pu concentrations in overstory vegetation at Area G (pCi/g ash).
Stations Outside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1980	1985	1994	1995	1996	1997	1998	1999	2001	2002
9	OS-9			0	0.002	0.051	0.007	0.002	0.0086	0.061	
8	OS-8					0.002	0.013	0.003	0.0033	0.001	0.0021
H-1	OS-H-1		0.021								
H-2	OS-H-2		0.020								
H-3	OS-H-3		0.028								
H-4	OS-H-4		0.010								
H-5	OS-H-5		0.010								
H-6	OS-H-6		0.006								
2	OS-2			0.006	0.004	0.004	0.033	0.016	0.0019	0.071	-0.0017
H-7	OS-H-7		0.013								
G-12	OS-G-12	0.45									
1	OS-1			0.007	0.003	0.005	0.023	0.064	0.0006	0.0073	0.11
H-8	OS-H-8		0.018								
H-9	OS-H-9		0.015								
H-10	OS-H-10		0.123								
H-11	OS-H-11		0.013								
H-12	OS-H-12		0.176								
6b	OS-6b								0.1925	0.0054	0.74
H-13	OS-H-13		0.140								
G-9	OS-G-9	0.81									
G-9	OS-G-9	0.62									

Table E-4. ^{239,240}Pu concentrations in overstory vegetation at Area G (pCi/g ash) (Cont.).

Stations Outside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1980	1985	1994	1995	1996	1997	1998	1999	2001	2002
G-41-02	OS-G-41-02										5.87
H-14	OS-H-14		0.100								
G-13	OS-G-13	0.57									
G-13	OS-G-13	3.28									
4	OS-4			0.012	0.055	0.003	0.167	0.087	0.0229	0.0029	
H-15	OS-H-15		0.570								
7c	OS-7c								0.0126	0.0034	0.118
H-16	OS-H-16		1.500								
H-16	OS-H-16		4.830								
3b	OS-3b								0.0013	0.0047	0.035

Stations Inside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1980	1994	1995	1996	1997	1998	1999	2001	2002
G-7	OS-G-7	0.62								
G-7	OS-G-7	0.26								
3	OS-3		0.024	0.023	0.078	2.788	0.104	0.0137	0.026	0.029

Table E-5. ^{tot}U concentrations in overstory vegetation at Area G (ppm ash).

Stations Outside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1994	1995	1996	1997	1998	1999	2001	2002
9	OS-9	0.33	0.38	1.21	0.478	0.6	0.52	0.49	
8	OS-8			0.794	0.791	0.88	0.71	0.3	0.72
2	OS-2	1.31	0.82	0.645	1.082	0.84	0.88	0.44	4.65
1	OS-1	1.19	0.47	2.079	1.010	1.31	0.73	0.33	0.63
6b	OS-6b						0.82	0.37	0.39
G-41-02	OS-G-41-02								0.77
4	OS-4	0.94	1.21	0.779	1.058	1.03	1.22	0.36	
7c	OS-7c						1.55	0.31	0.48
3b	OS-3b						0.56	0.55	0.78

Stations Inside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1994	1995	1996	1997	1998	1999	2001	2002
3	OS-3	3.29	2.46	2.939	3.130	2.24	2.39	0.79	0.8

APPENDIX F. RADIONUCLIDE CONCENTRATIONS IN UNDERSTORY VEGETATION COLLECTED AT AREA G SINCE 1980.

Table F-1. ^{3}H concentrations in understory vegetation at Area G (pCi/mL).
Stations Outside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1980	1985	1986	1994	1995	1996	1997	1998	1999	2001
9	US-9				1.1	0.1	0.37	0.12	2.83	0.4	0.23
8	US-8						-0.00	0.60	2.12	-0.01	0.11
H-1	US-H-1		0.70								
H-2	US-H-2		0.40								
H-3	US-H-3		0.10								
H-4	US-H-4		1.10								
H-5	US-H-5		3.00								
H-6	US-H-6		6.80								
G-15	US-G-15	0.4									
2	US-2				328	4200	4890	77.50	2624	2535	418
H-7	US-H-7		22.00								
G-12	US-G-12	22.9									
1	US-1				201.1	1400	8279	19.20	1974	637	900
H-8	US-H-8		7.70								
G-11	US-G-11	11.4									
H-9	US-H-9		8.10								
H-10	US-H-10			140							
G-10	US-G-10	11.3									
G-10	US-G-10	3.7									
H-12	US-H-12		3.50								
6b	US-6b									0.4	
H-13	US-H-13		3.90								
G-13	US-G-13	-2.0									
4	US-4				35.6	3.7	0.82	1.12	13.60	7.7	2.06
H-15	US-H-15		0.39								
G-14	US-G-14	248.0									
G-14	US-G-14	43.0									
7c	US-7c									3.77	2.74
G-1	US-G-1	-0.8									
H-16	US-H-16			120.0							
3b	US-3b									-0.18	1.63

Table F-1. ^{3}H concentrations in understory vegetation at Area G (pCi/mL) (Cont.).
Stations Inside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1980	1994	1995	1996	1997	1998	1999	2001
G-4	US-G-4	1450							
7a	US-7a				2.87			8	8
G-7	US-G-7	5.5							
G-2	US-G-2	1610							
G-2	US-G-2	15000							
G-6	US-G-6	1028							
6	US-6		952.5	2700	14744	1657			
5	US-5		177.3	7300	3788	664	5600	1820	

Table F-1. ^{3}H concentrations in understory vegetation at Area G (pCi/mL) (Cont.).
Stations Inside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1980	1994	1995	1996	1997	1998	1999	2001
G-5	US-G-5	19000							
G-5	US-G-5	3860							
G-8	US-G-8	64.8							
G-8	US-G-8	14.6							
7b	US-7b					10.60	23	4.8	7.15
G-3	US-G-3	3.3							
G-3	US-G-3	3.3							
3	US-3		38.2	3.2	0.70	0.76	5.58	1.65	3.78

Table F-2. ^{241}Am concentrations in understory vegetation at Area G (pCi/g ash).

Stations Outside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1994	1997	1998	1999	2001
9	US-9	0.002	0.002	0.006	0.004	0.004
8	US-8		0.008	0.003	0.001	0.001
2	US-2	0.008	0.015	0.004	0.004	0.003
1	US-1	0.010	0.007	0.019	0.003	0.003
6b	US-6b				0.071	
4	US-4	0.090	0.063	0.062	0.034	0.086
7c	US-7c				0.024	0.096
3b	US-3b				-0.004	0.002

Stations Inside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1994	1997	1998	1999	2001
7a	US-7a				0.005	0.006
6	US-6	0.006	0.157			
5	US-5	0.008	0.090	0.005	0.07	
7b	US-7b		0.108	0.035	-0.002	0.004
3	US-3	0.003	0.015	0.029	-0.003	0.004

Table F-3. ^{238}Pu concentrations in understory vegetation at Area G (pCi/g ash).
Stations Outside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1985	1994	1995	1996	1997	1998	1999	2001
9	US-9		0.002	0	0.001	0.003	0.003	-0.0012	-0.0013
8	US-8				0.001	0.001	0	-0.0006	-0.0045
H-1	US-H-1	0.003							
H-2	US-H-2	0.010							
H-3	US-H-3	0.021							
H-4	US-H-4	0.010							
H-5	US-H-5	0.006							
H-6	US-H-6	0.037							
2	US-2		0.006	0.003	0.002	0.002	0.002	-0.0023	0
H-7	US-H-7	0.001							
1	US-1		0.023	0.008	0.006	0.002	0.004	0.0026	0.001
H-8	US-H-8	0.009							
H-9	US-H-9	0.001							
H-12	US-H-12	0.080							
6b	US-6b							0.0091	
H-13	US-H-13	0.081							
4	US-4		0.452	0.080	0.057	0.092	0.042	0.0025	0.0151
H-15	US-H-15	0.029							
7c	US-7c							0.0201	0.062
3b	US-3b							-0.0026	-0.0001

Table F-3. ^{238}Pu concentrations in understory vegetation at Area G (pCi/g ash) (Cont.).
Stations Inside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1994	1995	1996	1997	1998	1999	2001
7a	US-7a			0.003			0.0002	-0.0001
6	US-6	0.003	0.004	0.004	0.017			
5	US-5	0.012	0.001	0.000	0.051	0.002	0.031	
7b	US-7b				0.011	0.002	0.0013	-0.0018
3	US-3	0.022	0.005	0.005	0.005	0.004	-0.0024	0.0035

Table F-4. ^{239,240}Pu concentrations in understory vegetation at Area G (pCi/g ash).
Stations Outside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1980	1985	1994	1995	1996	1997	1998	1999	2001
9	US-9			0.001	0.002	0.008	0.006	0.002	0.012	0.0014
8	US-8					0.005	0.006	0.001	0.0013	0.0016
H-1	US-H-1		0.017							
H-3	US-H-3		0.014							
H-4	US-H-4		0.030							
H-5	US-H-5		0.007							
H-6	US-H-6		0.047							
G-15	US-G-15	0.27								
2	US-2			0.013	0.010	0.007	0.014	0.008	0.0054	0.0038
H-7	US-H-7		0.009							
G-12	US-G-12	0.36								
1	US-1			0.021	0.014	0.011	0.028	0.011	0.0052	0.0012
H-8	US-H-8		0.014							
G-11	US-G-11	0.24								
G-10	US-G-10	0.34								
G-10	US-G-10	0.92								
H-12	US-H-12		1.040							
6b	US-6b								0.1279	
H-13	US-H-13		0.160							
G-13	US-G-13	10.6								
4	US-4			0.153	0.133	0.150	0.148	0.145	0.0114	0.021

Table F-4. ^{239,240}Pu concentrations in understory vegetation at Area G (pCi/g ash) (Cont.).
Stations Outside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1980	1985	1994	1995	1996	1997	1998	1999	2001
H-15	US-H-15		0.095							
G-14	US-G-14	0.5								
G-14	US-G-14	0.13								
7c	US-7c								0.0599	0.256
G-1	US-G-1	0.95								
3b	US-3b								0.006	0.0038

Table F-4. ^{239,240}Pu concentrations in understory vegetation at Area G (pCi/g ash) (Cont.).

Stations Inside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1980	1994	1995	1996	1997	1998	1999	2001
G-4	US-G-4	0.03							
7a	US-7a				0.014			0.006	0.0015
G-7	US-G-7	0.17							
G-2	US-G-2	0.1							
G-2	US-G-2	0.7							
G-6	US-G-6	0.95							
6	US-6		0.009	0.006	0.009	0.155			
5	US-5		0.014	0.009	0.013	0.051	0.014	0.0086	
G-5	US-G-5	1.55							
G-5	US-G-5	0.52							
G-8	US-G-8	0.05							

Table F-4. ^{239,240}Pu concentrations in understory vegetation at Area G (pCi/g ash) (Cont.).

Stations Inside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1980	1994	1995	1996	1997	1998	1999	2001
G-8	US-G-8	0.1							
7b	US-7b					0.120	0.046	0.0026	0.011
G-3	US-G-3	0.51							
G-3	US-G-3	0.29							
3	US-3		0.013	0.014	0.023	0.025	0.034	0.0051	0.0019

Table F-5. ^{tot}U concentrations in understory vegetation at Area G (ppm ash).

Stations Outside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1980	1994	1995	1996	1997	1998	1999	2001
9	US-9		0.36	0.57	1.16	0.484	0.38	1.94	0.16
8	US-8				1.132	0.430	0.94	0.73	0.15
G-15	US-G-15	0.5							
2	US-2		1.58	0.91	0.791	0.651	0.53	1.46	0.14
G-12	US-G-12	0.61							
1	US-1		2.05	0.94	0.473	0.458	0.61	0.82	0.22
G-11	US-G-11	0.57							
6b	US-6b							1.24	
G-13	US-G-13	0.38							
4	US-4		1.62	1.32	0.697	0.778	1.40	0.14	0.16
G-14	US-G-14	0.78							
G-14	US-G-14	0.39							
7c	US-7c							1.01	0.38
G-1	US-G-1	1.08							
3b	US-3b							2.04	0.2

Stations Inside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1980	1994	1995	1996	1997	1998	1999	2001
7a	US-7a				0.864			1.08	0.28
G-7	US-G-7	0.09							
6	US-6		1.72	0.86	0.943	1.253			

Table F-5. ^{tot}U concentrations in understory vegetation at Area G (ppm ash) (Cont.).

Stations Inside Area G: in order of occurrence along fence

Sample Location	Sample Designation	1980	1994	1995	1996	1997	1998	1999	2001
5	US-5		1.23	0.81	0.811	0.979	0.68	0.76	
7b	US-7b					0.642	1.03	0.6	0.13
G-3	US-G-3	0.44							
3	US-3		0.89	1.95	1.195	0.722	1.16	0.91	0.2


Los Alamos
NATIONAL LABORATORY